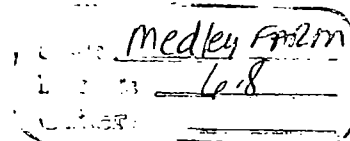


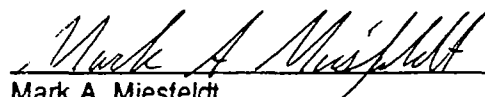



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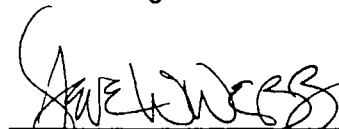


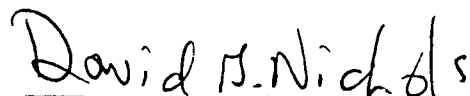
**PRELIMINARY REMEDIAL DESIGN REPORT  
FOR  
MEDLEY FARM SITE  
  
CHEROKEE COUNTY  
SOUTH CAROLINA**

November 1992

  
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### ***PREFACE***

A set of drawings has been developed to accompany this submittal. These drawings are referenced by title and number in the Table of Contents following this page.

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## Section 1 PROJECT DESCRIPTION

### 1.1 Background

On May 29, 1991, the United States Environmental Protection Agency (US EPA) issued its Record of Decision (ROD) for the Medley Farm Site. This document set forth the Agency's rationale and selected remedy for addressing affected ground water and soils identified at the site. The US EPA's Medley Farm ROD was based on the findings of the Remedial Investigation/Feasibility Study (RI/FS) conducted by the Settling Defendants for the Medley Site's technical consultant, Serrine Environmental Consultants, Inc. On October 9, 1991, the Settling Defendants for the Medley Farm Site (hereinafter referred to as the Medley Farm Site Steering Committee) formally entered into a Consent Decree outlining the basis for Remedial Design and Remedial Action at the site. The Consent Decree was formally entered with the United States District Court on January 17, 1992. The members of the Medley Farm Site Steering Committee have jointly agreed to implement the remedy defined by the ROD, the Consent Decree and Statement of Work (SOW), which is a part of the Consent Decree. The ROD and SOW comprise the primary technical resource documents that will be used during the design and implementation of the selected remedy.

RMT, Inc. (RMT) was retained by the Medley Farm Site Steering Committee to develop and implement the ROD-selected remedy. As a part of the required project deliverables, RMT prepared and submitted a Remedial Design Work Plan to the US EPA and the South Carolina Department of Health and Environmental Control (SC DHEC) for review and approval. This document described the general approach and schedule for completion of the Remedial Design portion of the RD/RA. The US EPA formally approved RMT's RD Work Plan for the Medley Farm Site on August 24, 1992.

This Preliminary Remedial Design Submittal is the <sup>NOT REALLY...</sup> first project deliverable called for under the approved RD project schedule. The Medley Farm SOW outlines specific US EPA technical requirements concerning the content of this document. This Preliminary Remedial Design Submittal has been prepared in accordance with the requirements of the Medley Farm ROD, Consent Decree, SOW and RD Work Plan.

## **1.2 Purpose and Scope**

The purpose of this document is to present RMT's process design basis and preliminary design concepts for the soil and ground water remediation systems at the Medley Farm Site. It is also the intent of this document to report the findings of data acquisition activities, outline general permitting strategies, describe RMT's approach for the remainder of the remedial design process, and establish a preliminary construction schedule.

The Preliminary Remedial Design Report is a project deliverable and milestone required in the RD Schedule. This report provides the US EPA and SC DHEC with an opportunity to review and comment upon design concepts and ideas that are proposed for more detailed design.

This document establishes a technical basis for more detailed design considerations and contains *preliminary process flow diagrams, process narratives, general arrangement drawings, sections, details, drawing lists, specification lists, and a preliminary construction schedule* for Agency review and consideration. Following approval of this document by the US EPA, RMT will initiate work upon the next significant milestone for the design project, the Pre-Final/Final Design Report.

## **1.3 Regulatory Requirements**

### **1.3.1 RD/RA Consent Decree**

Section VI.11.e (Pages 16-17) of the Medley Farm Consent Decree requires that the preliminary design submittal include the following: (1) design criteria; (2) results of treatability studies; (3) results of additional field sampling; (4) project delivery strategy; (5) preliminary plans, drawings, and sketches; (6) preliminary listing of specifications; (7) a plan for satisfying permitting requirements; and (8) [a] preliminary construction schedule. This document addresses these requirements.

### **1.3.2 Appendix B - Scope of Work**

Task II.B. (Pages 16-18) of the Scope of Work, entitled Preliminary Design, requires that the preliminary design include the following:

- Results of additional data acquisition activities;
- Design criteria report;
- Preliminary plans and specifications;
- Project delivery strategy;
- Plans for satisfying permitting requirements; and
- Preliminary construction schedule.

The content of this document addresses these requirements.

## Section 2

### RESULTS OF DATA ACQUISITION ACTIVITIES

#### 2.1 Supplemental Ground Water Characterization

In accordance with the ROD, Consent Decree and SOW, supplemental field activities have been implemented to further characterize ground water quality. These supplemental field activities include the following tasks:

- TASK 1. Conduct water quality testing of the site ground water to determine if additional treatment of the ground water is needed to address possible concerns for corrosion, scaling, precipitant formation, or other possible engineering contingencies associated with ground water treatment.
- TASK 2. Conduct additional evaluations and/or analytical testing of the ground water and surface water to identify possible inorganic constituents that may affect NPDES permitting considerations.
- TASK 3. Further assess the extent (vertical and horizontal) of the ground water contaminant plume in the northeast direction as described by the FSAP.

In addition, limited pumping tests will soon be conducted on SW-4 and SW-108 as described in the Project Change Notice MF-003, dated October 19, 1992. The objective of these limited pumping tests is to evaluate the saturated thickness and hydraulic conductivity of the underlying aquifer.

Ground water and surface water samples collected to address issues raised in Tasks 1 and 2 will be obtained during the fourth quarter of 1992. These data will be used to finalize preliminary design considerations prior to submission of the Pre-Final Design Report. The discussion that follows describes work that has been performed to further assess the horizontal and vertical extent of VOCs in the ground water northeast of the former disposal areas.

##### 2.1.1 Ground Water Screening Survey

A ground water screening survey was performed to better delineate the horizontal extent of VOCs in the ground water north and east of well pair SW-108 and BW-108. Data presented in the Medley Farm RI Report indicates that the stream, which borders the site to the east, is a ground water discharge area. Therefore, the ground water screening survey ~~will be~~ was conducted to assess water quality conditions near the water table. The results of this survey was used to determine the location of confirmation monitoring wells.

*In-situ* ground water samples were collected from the locations shown on Plate 1. Ground water samples were collected to the north and east of the unnamed tributary of Jones Creek until field VOC concentrations were observed to fall below their respective MCLs. *In-situ* ground water samples were collected using In-Situ Technology's "Direct Push Technology", further discussed in Section 5.6 of the FSAP. Ground water obtained using this system was screened in the field for volatile organic compounds using a portable gas chromatograph. Ground water screening results from this effort are summarized in Table 2-1.

#### **2.1.2 Monitoring Well Installation and Sampling**

Following the ground water screening survey, four ground water monitoring wells were installed on-site. Wells SW-201, BW-201, SW-202, and BW-202 were installed at locations approximated on Plate 1. The location of these monitoring wells, as noted on Plate 1, is subject to minor change based on the results of a pending ground survey. Monitoring wells SW-201 and SW-202 were installed to assess the horizontal extent of site constituents at the water table. Based on the results of the ground water screening survey, these wells were installed at the edge of or outside the area known to contain VOCs.

Since the ground water screening survey could not address water quality conditions in the bedrock, monitoring wells BW-201 and BW-202 were installed to assess the extent of VOCs in bedrock. These wells were installed as well pairs adjacent to the shallow wells. Water quality information obtained from these new wells will be used to enhance design of the ground water recovery system.

Drilling and well installation was accomplished according to the procedures outlined in Section 5.7 of the FSAP. The location and elevation of the newly installed wells will be determined by a land survey according to the procedures outlined in Section 3.4 of the FSAP.

Ground water samples were collected from these wells during the third quarterly sampling event, conducted during September and October 1992. Samples were collected according to the procedures outlined in Section 5.5 of the FSAP. Third quarter analytical results are not presently available, as they are still undergoing analysis.

TABLE 2-1

SUMMARY OF GROUND WATER SCREENING RESULTS \*

SAMPLE NO. SAMPLING DEPTH °	HC-1 <sup>b</sup> 32 Ft.	HC-2S <sup>b</sup> 15 Ft.	HC-2D <sup>b</sup> 30 Ft.	HC-3 <sup>b</sup> 18 Ft.
<b>VOLATILE ORGANICS</b>				
Toluene	0.003	0.004	ND	0.003
Tetrachloroethene	0.007	0.060	0.172	0.004
Trichloroethene	ND	0.065	0.160	ND
cis-1,2-Dichloroethene	ND	0.003	0.010	ND
Benzene	ND	ND	ND	ND
Ethyl Benzene	ND	ND	ND	ND
Xylenes	ND	ND	ND	ND
trans 1,2-Dichloroethene	ND	ND	ND	ND

a - In-situ ground water samples obtained using "direct-push" sampling technology developed by In Situ, Inc.

b - Analytical results are reported in parts per million.

Analysis performed using a portable gas chromatograph.

c - Depths measured in feet below land surface.

ND - Compound not detected.

NOTE: Because of the soil conditions at hydrocone sampling locations HC-4 and HC-5, no samples were collected.

## **2.2 Site Environmental Conditions**

The discussion in Sections 2.2.1 through 2.2.3 is based on information contained in the Medley Farm RI/FS Report prepared by Sirrine Environmental Consultants, the US EPA's Record of Decision, and RMT's recent field work.

### **2.2.1 Site Geology**

Residual soil at the site is absent or occurs as a thin layer overlying the saprolite. This soil layer ranges in thickness from zero to 11 feet and typically consists of clayey silt with varying amounts of fine sand, clay, silt and silty clay fill. The fill was probably placed on-site during the 1983 immediate removal action and site cleanup. Fill material and residual soil are not significant in terms of overall site geology.

The saprolite across the site, ranges in thickness from 50 to 70 feet near the former disposal areas to 7 to 28 feet along Jones Creek at the eastern boundary of the property. The lithologic characteristics of the saprolite are similar to the residual soils and are relatively consistent both vertically and horizontally. Saprolite observed in borings drilled at the site consists predominantly of a silt with varying amounts of fine to coarse sand, clay, mica flakes, and quartz gravel. The quartz gravel appears to be the erosional product of a later stage intrusive rock type. The saprolite grades downward into rock-type transitional between saprolite and bedrock. This interval is loosely defined by split-spoon refusal (i.e., N150). The thickness of the transition zone averages approximately 15 feet.

Site bedrock was investigated by continuous coring at numerous locations. The bedrock consists primarily of a gneiss that varies from a schistose gneiss to a quartzo-feldspathic and quartz-amphibole gneiss. In addition, a late stage quartz monzonite intrusive was noted. The quartz monzonite occurs as thin (<0.05 feet) layers within the gneissic rock type. The bedrock is predominantly hard, slightly weathered to fresh, gray, and fine to medium-grained, with closely to moderately-closely (0.5 to 2.5 feet) spaced joints. The joints tend to be smooth to rough and moderately dipping (35 to 55 degrees). Foliation of the bedrock is moderately dipping (35 to 55 degrees) to steep (55 to 85 degrees). Evidence of ground water movement through the bedrock was observed in the form of iron oxide staining along joint surfaces.

The configuration of the top of the bedrock surface approximates the shape of the topographic surface. A northeast-southwest trending bedrock high exists at the downgradient edge of the former disposal area. The bedrock high is centered on wells BW-109 and BW-2. To the northwest, beneath the former disposal areas, the surface of the bedrock is lower. The configuration of bedrock may, in part, control the distribution of VOCs in the ground water.

### **2.2.2 Site Hydrogeology**

Ground water at the Medley Farm Site occurs in the saprolite, in the zone of highly fractured and weathered bedrock zone (identified as the transition zone), and in moderately fractured bedrock immediately underlying the transition zone. Depth to ground water at the site varies from 56 to 68 feet in the disposal area, decreasing to six to eight feet near Jones Creek.

In general, ground water flow occurs through both porous and fractured media at the Medley Farm Site. The water table generally occurs in the saprolite across most of the Medley Farm property, with the saprolite serving as a porous medium for ground water flow. In the vicinity of BW-2 and SW-109, located at the eastern edge of the former disposal area and along the previously described bedrock high, the surface of the water table occurs in the bedrock transition zone. The ground water occurring in the saprolite and bedrock is part of interconnected water bearing units. Ground water within the bedrock at the site is assumed to be present under unconfined conditions for modeling considerations.

Yields from wells completed in the saprolite are generally low. Yields from bedrock wells are relatively high, but depend on the nature, quantity, and interconnection of the secondary (fracture) porosity the well encounters. The bedrock wells completed in the moderately fractured bedrock at the site demonstrate moderate yields in the range of five to seven gallons per minute. Ground water flow from wells completed in the saprolite can be quite slow, as evidenced by the length of the time (several hours for complete recovery of many site wells) for water levels to recover following bail-down.

Ground water flow at the Medley Farm Site occurs primarily to the southeast towards Jones Creek, as shown in Plate 1. The hydraulic gradient averages approximately 0.044 ft/ft across

# SDMS

Site Name: Medley Farms Box 1 of 13

Computer Disks: \_\_\_\_\_

CD-ROM: \_\_\_\_\_

Oversized Report: \_\_\_\_\_

Log Book: \_\_\_\_\_

Amount of material: 1 (Data Point Location Map in WATER TABLE CONFIGURATION - May 1992)

**\*Please contact the appropriate Records Center to view the material.\***

the site. The calculated horizontal ground water flow velocities are estimated to range from 1.1 feet/day (402 feet/year) to 1.3 feet/day (475 feet/year) for the saprolite.

Water level measurements collected in May 1992 from the six saprolite/bedrock well clusters indicate both upward and downward vertical hydraulic gradients. Upward vertical gradients were observed at two monitoring locations located adjacent to the unnamed tributaries to Jones Creek (BW-106/SW-106 and PZ-1/BW-3). These upward vertical ground water gradients indicate ground water discharge to these tributaries. Downward vertical gradients were observed at the remaining four locations (BW-1/SW-1, SW-4/BW-105, BW-108/SW-108 and BW-109/SW-109).

Jones Creek and its tributaries serve as zones of ground water discharge from the Medley Farm Site. Base flow in Jones Creek at the site is reported to be approximately 0.45 cfs (US EPA Record of Decision, 1991). During the RI field activities, water levels in the saprolite and bedrock adjacent to Jones Creek (PZ-1 and BW-3) were consistently above water levels measured during RI field activities observed in the tributary at staff gauge SL-3. The water level in BW-106 was greater than the water level observed in the tributary at staff gauge SL-5. However, the water level in SW-106 was less than the water level observed at staff gauge SL-5, indicating localized surface water recharge to the saprolite aquifer at this location.

### **2.2.3 Quarterly Ground Water Quality Results**

The Medley Farm RI identified the presence of volatile organic compounds (VOCs) in the underlying saprolite and bedrock units. The RI further indicated the presence of VOCs and semi-volatile organic compounds (SVOCs) in the unsaturated zone soils of several small areas of the site, where several former lagoons were once located. The chemicals described in Table 2-2 were identified as the primary Constituents of Concern (COCs) at the Medley Farm Site.

VOCs were detected in 12 of the site monitoring wells during the RI. These findings have been confirmed during the quarterly monitoring program implemented following entry of the RD/RA Consent Decree. The extent of site-related chemicals in the surface soils is limited to the former

**TABLE 2-2**  
**CONSTITUENTS OF CONCERN (COCs) FOR MEDLEY FARM SITE BY MEDIUM**

	Surface Soils	Ground Water (Saprolite)	Ground Water (Bedrock)
<b><i>Volatile Organic Compounds</i></b>			
1,1-Dichloroethene		X	X
1,1-Dichloroethane		X	
1,1,1-Trichloroethane		X	X
1,1,2-Trichloroethane	X	X	
1,1,2,2-Tetrachloroethane	X		
1,2-Dichloroethane			X
1,2-Dichloroethene(total)	X	X	X
1,2-Dichloropropane	X		
2-Butanone			X
Acetone			X
Benzene			X
Chloroform			X
Chloromethane		X	
Ethylbenzene	X		
Methylene Chloride	X	X	X
Styrene	X		
Tetrachloroethene	X	X	X
Trichloroethene	X	X	X
Vinyl Chloride	X		
<b><i>Semi-Volatile Organic Compounds</i></b>			
1,2,4-Trichlorobenzene	X		
Butylbenzylphthalate	X		
Di-n-butylphthalate	X		
Di-n-octylphthalate	X		
bis(2-Ethylhexyl)phthalate	X		

X Denotes Chemical Detected in Medium

disposal area. There are no indications of COCs in the stream sediments or surface water of the intermittent tributaries.

Ground water samples have been collected for three successive quarters from the Medley Farm Site. Analytical results from the first two quarters are summarized in Tables 2-3 and 2-4. Ground water quality exceedances of the ROD potential remediation levels are shown on Plate 2.

Water quality data from the third quarterly sampling episode is still in analysis and unavailable for this report. These results will be transmitted to the US EPA under separate cover when they have been validated.

#### **2.2.4 Subsurface Soil Results**

No vertical pattern of chemical distribution in subsurface soils is apparent. Elevated concentrations of waste constituents were generally found at depths less than 17 feet. Elevated concentrations of VOCs were noted at depths of 27 feet in soil borings SB-2, SB-4, and SB-9. Subsurface soil sampling locations are shown on Plate 1. Analytical data for subsurface soils are summarized on Table 2-5.

### **2.3 Preliminary Capture Zone Analysis**

Given the chemistry and distribution of VOCs observed in the site ground water, a series of pumping wells and associated treatment systems is needed to provide effective remediation (Section 3). Since ground water flow from the source area follows divergent easterly and southeasterly paths, efficient interception of the plume will require a bifurcated system of downgradient pumping wells. Ground water capture analyses have been performed, in order to gauge the merits of such a system.

Modeling of the capture zones was based on GPTRAC, a general particle tracking module of the Wellhead Protection Area (WHPA) computer program series. This program provides for pathline and time-related definition of capture, in situations involving well interference. Since critical aquifer characteristics are incompletely defined across the site, the version used assumed a homogeneous aquifer and provided semi-analytical solutions. Model pumping wells were positioned downgradient of the monitoring wells known to contain COCs, at locations thought to approximate the edge of the plume

TABLE 2-3

**QUARTERLY SAMPLING DATA SUMMARY<sup>a</sup>**  
**FEBRUARY 1992**  
**MEDLEY FARM SITE**

PARAMETERS	SW01	SW03	SW03 DL	SW04	SW101	SW106	SW108
	19-Feb-92	18-Feb-92	18-Feb-92	18-Feb-92	20-Feb-92	19-Feb-92	17-Feb-92
<b>VOLATILE ORGANIC COMPOUNDS</b>							
Acetone	0.004 BJ	0.006 BJ	<0.025	0.17 BJ	0.007 BJ	0.019 B	<0.010
Benzene	<0.010	<0.010	<0.025	<0.250	<0.010	<0.010	<0.010
2-Butanone	<0.010	<0.010	<0.025	<0.250	<0.010	<0.010	<0.010
Chloroform	<0.010	<0.010	<0.025	<0.250	<0.010	<0.010	0.003 J
1,1-Dichloroethane	<0.010	<0.010	<0.025	0.026 J	<0.010	0.001 J	0.005 J
1,2-Dichloroethane	<0.010	<0.010	<0.025	<0.250	<0.010	<0.010	0.002 J
1,1-Dichloroethene	<0.010	0.0008 J	<0.025	2.3	0.005 J	<0.010	0.016
1,2-Dichloroethene (total)	<0.010	0.003 J	0.002 DJ	0.019 J	<0.010	<0.010	0.006 J
4-Methyl-2-pentanone	<0.010	<0.010	<0.025	<0.250	<0.010	<0.010	<0.010
Tetrachloroethene	<0.010	0.30 E	0.30 D	<0.250	<0.010	<0.010	0.038
Toluene	<0.010	<0.010	<0.025	<0.250	<0.010	<0.010	<0.010
1,1,1-Trichloroethane	<0.010	<0.010	<0.025	2.4	0.002 J	<0.010	0.008 J
1,1,2-Trichloroethane	<0.010	<0.010	<0.025	<0.250	<0.010	<0.010	<0.010
Trichloroethene	<0.010	0.18	0.18 D	0.011 J	0.0005 J	<0.010	0.057
<b>SEMIVOLATILE ORGANIC COMPOUNDS</b>							
bis(2-Ethylhexyl)phthalate		<0.010		<0.010			

a Analytical results are reported in parts per million.  
 B Analyte present in field blank.  
 D Dissolved analyte greater than total analyte. Analyses pass QC based on precision criteria.  
 NOTE: Shading denotes an exceedance of potential ground water remediation.

DL Sample diluted before analysis.  
 E Elevated detection limit due to matrix effects.  
 J Estimated concentration.

TABLE 2-3

QUARTERLY SAMPLING DATA SUMMARY <sup>a</sup>  
 FEBRUARY 1992  
 MEDLEY FARM SITE

PARAMETER	BW01	BW02	DU02	DU02 DL	BW04	BW105	BW106	BW108	BW108 DL
	19-Feb-92	20-Feb-92	20-Feb-92	20-Feb-92	20-Feb-92	18-Feb-92	19-Feb-92	17-Feb-92	17-Feb-92
<b>VOLATILE ORGANIC COMPOUNDS</b>									
Acetone	0.005 BJ	0.030 BJ	0.005 BJ	<0.050	0.004 BJ	<0.010	0.005 BJ	0.020 BJ	0.020 BDJ
Benzene	<0.010	<0.050	<0.010	<0.050	<0.010	<0.010	<0.010	0.001 J	0.001 DJ
2-Butanone	<0.010	<0.050	<0.010	<0.050	<0.010	<0.010	<0.010	<0.025	<0.050
Chloroform	<0.010	0.011 J	0.010	0.012 DJ	<0.010	<0.010	<0.010	0.027	0.031 DJ
1,1-Dichloroethane	<0.010	<0.050	<0.010	<0.050	<0.010	<0.010	<0.010	0.004 J	0.005 DJ
1,2-Dichloroethane	<0.010	0.52	0.50 E	0.55 D	<0.010	<0.010	<0.010	0.015 J	0.017 DJ
1,1-Dichloroethene	<0.010	0.30	0.30 E	0.30 D	<0.010	0.005 J	<0.010	0.19	0.19 D
1,2-Dichloroethene (total)	<0.010	0.003 J	0.003 J	0.003 DJ	<0.010	<0.010	<0.010	0.027	0.028 DJ
4-Methyl-2-pentanone	<0.010	<0.050	<0.010	<0.050	<0.010	0.003 J	<0.010	<0.025	<0.050
Tetrachloroethene	<0.010	0.020 J	0.018	0.020 DJ	<0.010	<0.010	<0.010	0.40	0.48 D
Toluene	<0.010	<0.050	<0.010	<0.050	<0.010	<0.010	<0.010	<0.025	<0.050
1,1,1-Trichloroethane	<0.010	0.17	0.15	0.16 D	<0.010	0.012	0.0006 J	0.11	0.12 D
1,1,2-Trichloroethane	<0.010	<0.050	0.002 J	<0.050	<0.010	<0.010	<0.010	0.001 J	<0.050
Trichloroethene	<0.010	0.63	0.52 E	0.66 D	<0.010	<0.010	<0.010	0.68 E	0.81 D
<b>SEMI-VOLATILE ORGANIC COMPOUNDS</b>									
bis(2-Ethylhexyl)phthalate		0.009 J	<0.010			0.006 J			

a Analytical results are reported in parts per million.  
 B Analyte present in field blank.  
 D Dissolved analyte greater than total analyte. Analyses pass QC based on precision criteria.  
 NOTE: Shading denotes an exceedance of potential ground water remediation.

DL Sample diluted before analysis.  
 E Elevated detection limit due to matrix effects.  
 J Estimated concentration.

TABLE 2-3

QUARTERLY SAMPLING DATA SUMMARY <sup>a</sup>  
 FEBRUARY 1992  
 MEDLEY FARM SITE

PARAMETERS	RW05	RW06	DU01	FBLK01	RBLK01	TBLK01	TBLK02
	19-Feb-92	20-Feb-92	20-Feb-92	18-Feb-92	19-Feb-92	17-Feb-92	11-Feb-92
<b>VOLATILE ORGANIC COMPOUNDS</b>							
Acetone	0.009 BJ	0.007 BJ	<0.012	0.006 BJ	0.024 B	0.005 BJ	0.005 BJ
Benzene	<0.010	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
2-Butanone	<0.010	<0.010	0.003 J	<0.010	<0.010	<0.010	<0.010
Chloroform	<0.010	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
1,1-Dichloroethane	<0.010	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
1,2-Dichloroethane	<0.010	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
1,1-Dichloroethene	<0.010	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
1,2-Dichloroethene (total)	0.0008 J	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
4-Methyl-2-pentanone	<0.010	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
Tetrachloroethene	0.003 J	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
Toluene	<0.010	<0.010	0.010 J	<0.010	<0.010	<0.010	<0.010
1,1,1-Trichloroethane	0.0007 J	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
1,1,2-Trichloroethane	<0.010	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
Trichloroethene	0.005 J	<0.010	<0.012	<0.010	<0.010	<0.010	<0.010
<b>SEMIVOLATILE ORGANIC COMPOUNDS</b>							
bis(2-Ethylhexyl)phthalate							

a Analytical results are reported in parts per million.  
 B Analyte present in field blank.  
 D Dissolved analyte greater than total analyte. Analyses pass QC based on precision criteria.  
 NOTE: Shading denotes an exceedance of potential ground water remediation.

DL Sample diluted before analysis.  
 E Elevated detection limit due to matrix effects.  
 J Estimated concentration.

TABLE 2-4

**QUARTERLY SAMPLING DATA SUMMARY  
MEDLEY FARM JUNE, 1992**

PARAMETERS <sup>a</sup>	BW01	BW02	BW04	BW105	BW108	BW108	BW108 DL	DU03 (BW108)	SW01	SW03
<b>VOLATILE ORGANIC COMPOUNDS</b>										
Benzene	<0.010	<0.062	<0.010	<0.010	<0.010	<0.010	<0.062	0.002 J	<0.010	<0.010
Chloroform	<0.010	<0.062	<0.010	<0.010	<0.010	<0.007 BJ	<0.062	0.009 J	<0.010	<0.010
1,1-Dichloroethane	<0.010	<0.062	<0.010	<0.010	<0.010	0.004 J	0.004 DJ	0.005 J	<0.010	<0.010
1,2-Dichloroethane	<0.010	0.65	<0.010	<0.010	<0.010	0.014	0.019 DJ	0.015 J	<0.010	<0.010
1,1-Dichloroethene	<0.010	0.40	<0.010	0.006 J	<0.010	0.079	0.11 D	0.088	<0.010	<0.010
1,2-Dichloroethene (total)	<0.010	<0.062	0.003 J	<0.010	<0.010	0.026	0.037 DJ	0.031 J	<0.010	0.004 J
Tetrachloroethene	<0.010	0.026 J	<0.010	<0.010	<0.010	0.47 E	0.56 D	0.49	<0.010	0.38 E
1,1,1-Trichloroethane	<0.010	0.20	<0.010	0.013	<0.010	0.051	0.061 DJ	0.052 J	<0.010	0.0007 J
Trichloroethene	<0.010	0.82	0.001 J	<0.010	<0.010	0.78 E	0.92 D	0.78	<0.010	0.26 E

a - Analytical results are reported in parts per million.

B - Analyte present in analytical method blank.

D,DL - Sample diluted before analysis.

E - Concentration exceeded calibration range of instrument.

J - Estimated concentration.

NOTE: Shading denotes an exceedance of potential ground water remediation levels.

TABLE 2-4 (Continued)

**QUARTERLY SAMPLING DATA SUMMARY  
MEDLEY FARM JUNE, 1992**

PARAMETERS <sup>a</sup>	SW03DL	SW04	SW101	SW106	SW108	FBLK02	RBLK02	TBLK03	TBLK04
<b>VOLATILE ORGANIC COMPOUNDS</b>									
Benzene	<0.025	<0.12	<0.010	<0.010	0.0005 J	<0.010	<0.010	<0.010	<0.010
Chloroform	<0.025	<0.12	<0.010	<0.010	0.004 BJ	<0.010	<0.010	<0.010	<0.010
1,1-Dichloroethane	<0.025	0.024 J	<0.010	0.001 J	0.004 J	<0.010	<0.010	<0.010	<0.010
1,2-Dichloroethane	<0.025	<0.12	<0.010	<0.010	0.002 J	<0.010	<0.010	<0.010	<0.010
1,1-Dichloroethene	<0.025	1.5	0.005 J	0.002 J	0.021	<0.010	<0.010	<0.010	<0.010
1,2-Dichloroethene (total)	<0.025	0.018 J	0.003 J	<0.010	0.006 J	<0.010	<0.010	<0.010	<0.010
Tetrachloroethene	0.44 D	<0.12	<0.010	<0.010	0.048	<0.010	<0.010	<0.010	<0.010
1,1,1-Trichloroethane	<0.025	2.5	0.002 J	<0.010	0.013	<0.010	<0.010	<0.010	<0.010
Trichloroethene	0.31 D	0.008 J	<0.010	0.001 J	0.077	<0.010	<0.010	<0.010	<0.010

a - Analytical results are reported in parts per million.

B - Analyte present in analytical method blank.

D,DL - Sample diluted before analysis.

E - Concentration exceeded calibration range of instrument.

J - Estimated concentration.

NOTE: Shading denotes an exceedance of potential ground water remediation levels.

U . S . E P A R E G I O N I V

# SDMS

## Unscannable Material Target Sheet

DocID: 4284 Site ID: SCD980558142

Site Name: Medley Farms Box 6 IF13

### Nature of Material:

Map: ✓

Computer Disks: \_\_\_\_\_

Photos: \_\_\_\_\_

CD-ROM: \_\_\_\_\_

Blueprints: \_\_\_\_\_

Oversized Report: \_\_\_\_\_

Slides: \_\_\_\_\_

Log Book: \_\_\_\_\_

Other (describe): \_\_\_\_\_

Amount of material: (1) Distribution of VOCs Exceeding Potential Ground Water Remediation Levels

\*Please contact the appropriate Records Center to view the material.\*

# SDMS

## Unscannable Material Target Sheet

DocID: 4284 Site ID: SCD980558142

Site Name: Medley Farms Bay 6 of 13

### Nature of Material:

Map: ☒

Computer Disks: ☐

Photos: ☐

CD-ROM: ☐

Blueprints: ☐

Oversized Report: ☐

Slides: ☐

Log Book: ☐

Other (describe): ☐

Amount of material: 1 (THEORETICAL CAPTURE ZONES)

\*Please contact the appropriate Records Center to view the material.\*

TABLE 2-6

SINGLE WELL HYDRAULIC CONDUCTIVITIES AND ASSOCIATED LITHOLOGIES

Well Lithology	Slug Test Conductivity (cm/sec)	Pressure Test Conductivity (cm/sec)	Intake
SW-1	$3.8 \times 10^{-5}$	-----	Saprolite
SW-3	$7.8 \times 10^{-4}$	-----	Saprolite+Transition
SW-4	$1.6 \times 10^{-4}$	-----	Saprolite
SW-102	$1.6 \times 10^{-3}$	-----	Saprolite+Transition
SW-103	$1.1 \times 10^{-4}$	-----	Saprolite+Transition
SW-104	$7.8 \times 10^{-4}$	-----	Saprolite
SW-106	$8.5 \times 10^{-4}$	-----	Saprolite
SW-108	$3.1 \times 10^{-5}$	-----	Saprolite
SW-109	$3.0 \times 10^{-3}$	-----	Saprolite+Transition
BW-1	$3.8 \times 10^{-3}$	-----	Shallow Bedrock
BW-2	$2.3 \times 10^{-3}$	$2.6 \times 10^{-4}$	Shallow Bedrock
BW-3	$1.9 \times 10^{-3}$	$2.8 \times 10^{-4}$	Shallow Bedrock
BW-4	$1.9 \times 10^{-4}$	$1.7 \times 10^{-4}$	Shallow Bedrock
BW-106	-----	$4.1 \times 10^{-4}$	Shallow Bedrock
BW-108	-----	$4.4 \times 10^{-5}$	Shallow Bedrock
BW-109	-----	$2.5 \times 10^{-4}$	Shallow Bedrock
BW-110	-----	$2.6 \times 10^{-4}$	Shallow Bedrock
BW-111	-----	$1.7 \times 10^{-7}$	Deep Bedrock
BW-112	-----	$3.1 \times 10^{-7}$	Deep Bedrock

Information from "Final Remedial Investigation Report, Medley Farm Site, Gaffney, S.C.",  
Sirrinc Environmental Consultants, February 1991.

SW wells are screened. BW wells are open hole.

**TABLE 2-7**  
**HYDRAULIC CONDUCTIVITY STATISTICS**  
(Values in cm/sec)

Lithology <sup>a</sup>	Wells in Unit	Arithmetic Mean k	Variance	Geometric Mean k
Saprolite	SW-1, SW-4, SW-104, SW-106, SW-108	$3.7 \times 10^{-4}$	$1.7 \times 10^{-7}$	$1.7 \times 10^{-4}$
Saprolite + Transition	SW-3, SW-102, SW-103, SW-109	$1.4 \times 10^{-3}$	$1.5 \times 10^{-6}$	$8.0 \times 10^{-4}$
Soil-Bearing	SW-1, SW-3, SW-4, SW-102, SW-103, SW-104, SW-106, SW-108, SW-109	$8.2 \times 10^{-4}$	$9.4 \times 10^{-7}$	$3.3 \times 10^{-4}$
Shallow Bedrock	BW-1, BW-2, BW-3, BW-4, BW-106, BW-108, BW-109, BW-110	$6.8 \times 10^{-4}$	$1.6 \times 10^{-6}$	$2.9 \times 10^{-4}$
Shallow Bedrock Without BW-1	BW-2, BW-3, BW-4, BW-106, BW-108, BW-109, BW-110	$2.4 \times 10^{-4}$	$1.2 \times 10^{-8}$	$2.0 \times 10^{-4}$
Deep Bedrock	BW-111, BW-112	$2.4 \times 10^{-7}$	$9.8 \times 10^{-15}$	$2.3 \times 10^{-7}$
Potential Aquifer	SW-1, SW-3, SW-4, SW-102, SW-103, SW-104, SW-106, SW-108, SW-109, BW-2, BW-3, BW-4, BW-106, BW-108, BW-109, BW-110	$5.6 \times 10^{-4}$	$6.0 \times 10^{-7}$	$2.7 \times 10^{-4}$

<sup>a</sup> Lithologic unit within which the screened interval (SW wells), or open hole (BW wells) lies.

**TABLE 2-8**  
**STUDENT'S T-TEST COMPARISONS**  
**OF HYDRAULIC CONDUCTIVITY ARITHMETIC MEANS**

Lithologic Groups Compared	Significant Difference at the 95% Confidence Level?
Saprolite vs. Saprolite + Transition	No
Soil-Bearing vs. Shallow Bedrock	
With BW-1	No
Without BW-1	No
Soil-Bearing vs. Deep Bedrock	Yes
Shallow Bedrock vs. Deep Bedrock	
With BW-1	Yes
Without BW-1	Yes
Soil-Bearing + Shallow Bedrock vs. Deep Bedrock	
With BW-1	Yes
Without BW-1	Yes

It is reasonable to assume, then, that all saprolite, transition zone and shallow bedrock well intakes may penetrate portions of the effective aquifer. The sixteen well mean, excluding only the values for wells BW-1, BW-111 and BW-112, may be accepted as a first-order approximation of the aquifer hydraulic conductivity. Since arithmetic conductivity means tend to be skewed in favor of higher values in the groups considered, geometric means are more appropriate overall averages. The "potential aquifer" geometric mean conductivity of  $2.7 \times 10^{-4}$  cm/sec (Table 2-7) was the value used in all GPTRAC calculations.

Aquifer flow and capture characteristics are critically dependent on the transmissivity of the unit. Given conductivity, determination of an average aquifer transmissivity requires a value for aquifer thickness. Of all the necessary model input parameters, effective thickness is probably the least well defined. The statistical comparisons discussed above suggest a reasonably homogeneous aquifer through the terminal depths of the various shallow bedrock boreholes. The depths in question lie 13 to 34 feet beneath the bottom of the transition zone, implying an average aquifer thickness of over 54 feet. It may be inappropriate, however, to assume that similar conductivities above and below the bedrock interface imply a coherent aquifer through the entire depth range. Measured bedrock conductivities may be significantly higher than naturally occurring values, for example, due to stress fracturing associated with the boring process. Furthermore, there is no guarantee that any particular volume of bedrock is directly connected to the surface aquifer. Attempting to judge thickness on the basis of borehole petrography does not clarify matters. Highly weathered and fractured gneiss gives way, in several boreholes, to relatively fresh rock. Deeper fractures in both units are filled with epidote. Defining the bottom of a potential aquifer as the first occurrence of either fresh rock or filled fractures leads to an average thickness of about forty feet. The fresh rock cannot be assumed to constitute a ubiquitous and impermeable aquifer base, however, since it interfingers with the gneiss and gives the appearance of being a younger, irregularly distributed intrusive. Since the boreholes containing epidote-healed fractures exhibit approximately the same conductivities as those which do not, it is also difficult to contend that fracture filling forms any sort of coherent base. Lacking hydraulic definition of an aquifer base, a fifty foot total effective thickness has been assumed. Analyses of results from the pumping tests proposed in Section 2.1 are expected to provide the desired hydraulic definition.

Capture zones were modeled for a variety of well configurations. Input parameters were iteratively adjusted to minimize the number of pumping wells required for efficient containment of the plume.

Final input values are detailed in Table 2-9. Final well placements and various time-dependent zones of ground water capture are illustrated on Plate 3. Calculations assumed that there are no boundaries to flow. Each of the eight pumping wells ultimately required was theoretically pumped at a rate of 3.4 gallons per minute. That figure represents the maximum rate possible, given the average transmissivity and thickness. As illustrated on Plate 3, areas of effective capture grow most quickly in an upgradient direction. Lateral development tends to be an inverse function of the distance between neighboring wells. Capture zone coalescence leads to virtually complete interception of downgradient COC migration, within a period of two years. Ground water within the entire area thought to contain remediation level exceedances is captured within five years. Unless the results of planned pumping tests are at significant variance with the conductivity and aquifer thickness estimates discussed above, capture of plume ground water will likely be achievable by operating eight pumping wells positioned as shown on Plate 3.

#### 2.4 Property Survey

During the preparation of the Pre-Final Design Report, a boundary survey of the Medley Farm property will be conducted to locate and retrace property boundaries. This survey will identify easements, rights-of-way, and boundary infringements that may exist. This work will be conducted by a land surveyor registered by the State of South Carolina. The surveyor will prepare a plat for the site in conformance with the Minimum Standards for Land Surveying in South Carolina. Information from this survey will be incorporated into the design drawings.

If not, more wells! 2 yrs. OK, longer,  
maybe not OK...

**TABLE 2-9**  
**PROGRAM GPTRAC INPUT VALUES**  
**FOR GROUND WATER CAPTURE ZONE MODELING ANALYSES**

Parameter	Input Value
Flow Direction	0 to 305 degrees
Flow Gradient	0.044-0.073 ft/ft
Effective Porosity	0.25
Average Thickness	50 feet
Average Hydraulic Conductivity	0.76 ft/day
Average Transmissivity	38.0 ft <sup>2</sup> /day
Type of Aquifer	Unconfined
Number of Pumping Wells	8
Step Length	5 feet
Flow Boundaries	No boundaries
Areal Recharge Rate	8 inches per year
Pumping Rate	3.4 GPM per well
Well Diameters	6 inch
Pumping Times Modeled	0.25, 0.5, and 1,2,3,5 yrs.

### Section 3 PRELIMINARY DESIGN

#### 3.1 Site-Specific Geologic and Hydrologic Influences on Design Basis

Additional data gathering and analytical activities proposed in the Medley Farm FSAP and RD Workplan are intended to further investigate and confirm the nature and extent of VOC constituents present within the soils and ground water of the Medley Farm Site. The overall objectives for these supplemental field activities included:

- Collecting additional ground water quality data and hydrogeologic data northeast of the former disposal areas;
- Filling data gaps within the existing database; and
- Further characterizing the hydrogeologic and geologic parameters that will influence the remedial design.

As described in the FSAP, data was collected in stages with the initial data collection efforts being primarily focused toward better assessment of the horizontal and vertical extent of affected ground water in the northeast quadrant. Subsequent data collection efforts have been conducted to identify and fill in data gaps and supplement the existing database.

As a result of these efforts, several issues have been identified which influence the final remedial design. These issues include:

- Determining whether the unnamed tributary to Jones Creek acts as a no flow boundary;
- Evaluating the effect the northeast-southwest trending bedrock high, located immediately downgradient of the former disposal areas, exerts towards controlling the distribution of VOCs in the ground water;
- Assessing the degree to which observed intrusive quartz monzonite layers, identified in the Medley Farm bedrock cores, influence contaminant transport through the ground water; and
- Determining the hydraulic conductivity and saturated thickness of the aquifer with greater precision to facilitate future modeling efforts and design considerations.

### 3.1.1 Boundary Flow Conditions

To further investigate if the unnamed tributary to Jones Creek acts as a no flow boundary, an *in-situ* screening survey was conducted and monitoring well pair SW-201 and BW-201 were installed. In addition, a limited pumping test at the existing two-inch monitoring well SW-108 has been proposed and approved by US EPA (reference Appendix A - Project Change Notice MF-003). The water quality data obtained from the new well cluster SW/BW-201, combined with the data generated during the pumping test on Sw-108 should provide further information regarding this technical issue. RMT's preliminary design calls for the installation of a six-inch, permanent pumping well (A-4) in this area for the expressed purpose of conducting formal pumping tests. At this point in the design process, we continue to believe that the unnamed tributary to Jones Creek serves as a no flow boundary.

see  
sec.  
5

### 3.1.2 Effect of Subsurface Geology on VOC Transport

Based on information presented in the Medley Farm RI report, a northeast-southwest trending bedrock high has been interpreted as present along the downgradient edge of the former disposal areas. Historical water quality data suggests that this geologic feature may be controlling the movement of VOCs in ground water. To further evaluate the extent to which this feature controls the distribution of VOCs, additional geologic hydrogeologic, and water quality data has either been proposed or collected.

Preliminary capture zone modeling predicts that a system of eight ground water extraction wells (Plate 3) will contain the VOC plume described by the quarterly sampling data. RMT proposes to install three of these eight wells (A-1, A-4, and B-4) during the remedial design to collect additional site data. Pumping wells B-4 and A-1 have been intentionally located in the vicinity of this observed bedrock high. Additional geologic information and water quality data will be obtained as wells A-1 and B-4 are installed. By conducting formal pumping tests on B-4 and examining the stratigraphic information from A-1 and B-4, we expect to improve understanding of the underlying geology and hydrology and thereby optimize the locations for the remaining pumping wells.

While viewing the bedrock cores obtained from the Medley Farm Site during installation of monitoring wells BW-201 and BW-202, RMT noted the presence of resistant intrusive quartz

monzonite layers. Although these layers appear to be continuous, it is more likely that they are fractured and broken. These intrusive layers may also influence the horizontal and vertical transport of VOCs in the ground water. Once more, the data obtained as pumping wells A-1, A-4, and B-4 are installed will be crucial to address this consideration.

### **3.1.3 Aquifer Characteristics**

To better assess site ground water flow characteristics, a series of pumping tests will be performed. Water level data collected during these tests will be used to calculate hydraulic conductivity, transmissivity, storativity, and the saturated thickness of the aquifer. These parameters can then be input into a site ground water flow model which, when calibrated, will be used to properly locate additional pumping wells, as needed.

Pumping tests will first be performed on existing monitoring wells SW-4 and SW-108 as described by Project Change Notice MF-003 (Appendix A). These pumping tests will be used to address RMT's prior concerns with hydraulic conductivity test results obtained during the RI, confirm the preliminary number and location of recovery wells prescribed by the capture zone modeling, and develop the basis for a site ground water flow model.

Following installation of pumping wells A-4 and B-4 and analysis of the pumping test results from these wells, a ground water flow model will be developed for the Medley Farm Site. The model will be used to evaluate the effectiveness of the ground water recovery system in achieving the remedial objectives stated in the ROD.

In summary, RMT has adapted a comprehensive strategy of utilizing every possible opportunity to enhance and expand our knowledge of site conditions. By so doing, the required number of extraction wells for both ground water and soil vapor extraction can be minimized, while at the same time optimizing the output and efficiency of these wells. An understanding of the subsurface geology will enable RMT to develop a remedial design that incorporates the inherent advantages of using existing geologic features during the remediation to improve the efficiency of the soil and ground water extraction systems.

### 3.2 Process Description

RMT's conceptual process design for the Medley Farm Site Remedy generally consists of a skid-mounted soil vapor extraction (SVE) system for the VOC-affected soils, a system of jet-pump ground water extraction wells for pumping of VOC-contaminated ground water, a packed-tower air-stripping unit for removal of the VOCs from the ground water, and a diffuser system for discharge of treated ground water by way of a NPDES-permitted outfall to Jones Creek. RMT's general approach for this project was first presented to the US EPA and SC DHEC in a Technical Memorandum, dated March 6, 1992. In this document, RMT presented site photographs of a similar remediation system in operation at a Fountain Inn, South Carolina location.

A more detailed process narrative for each of the ground water treatment and soil vapor extraction systems is provided in Sections 3.2.1 and 3.2.2. At this time, the design criteria for each of these systems is based upon the assumption that air emissions from both the ground water and soil removal systems will not require treatment to achieve minimum SC DHEC air quality requirements.

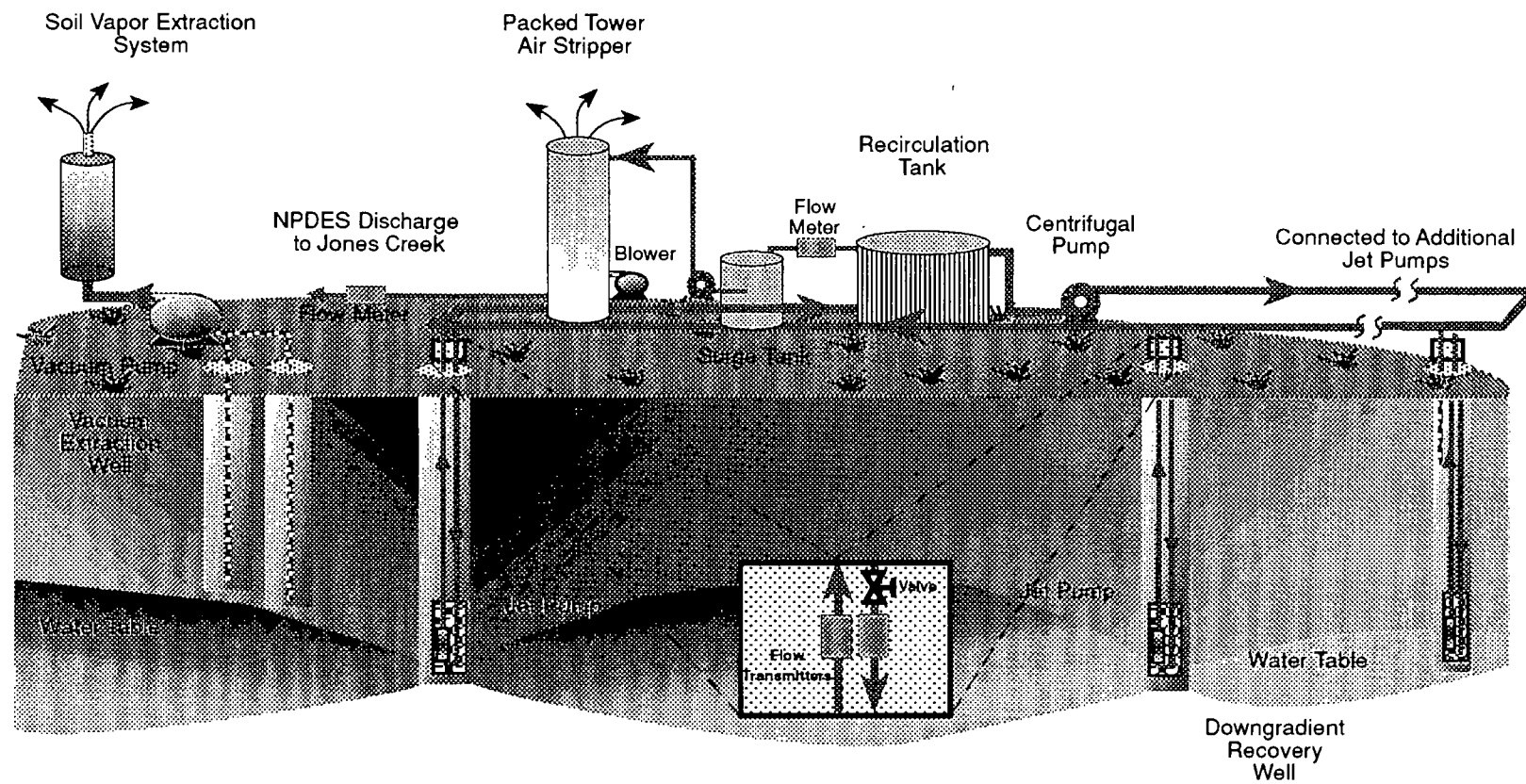
IF REQ'D: How much time do we  
lose?

#### 3.2.1 Ground Water Recovery and Treatment System

##### Ground Water Recovery

Dual (bifurcated) jet pump collection systems are envisioned for use at the Medley Farm Site. Each of these systems is intended to function independently of one another, yet they both are intended to collect ground water from within a discrete portion of the plume of VOC constituents. A generalized arrangement of the Medley Farm remedy is shown in Figure 3-1.

The remedial design for the Medley Farm Site has been developed to accommodate a large degree of flexibility with respect to possible changes and modifications that may become necessary in response to changing site conditions or remedial objectives. A review of the text and drawings provided herein will illustrate the provision for a third jet pump system (DWG. 938-C03), should the need arise. At this point in time, the dual jet pump systems are believed to be adequate to address the site remedial objectives. The third system is shown only to emphasize the fact that the design does take future contingency into account.



A jet pump recovery system is intentionally designed as a reliable and uncomplicated means of extracting ground water from the subsurface and conveying it to a centralized treatment system. The most important components of a jet pump system are the centrifugal pump (prime mover), the jet pump ejector, and the associated piping. Figure 3-1 provides a conceptual view of these various components as they interact with one another. The jet pump ejector is installed near the bottom of each pumping well. Each pumping well is constructed as shown in Figure 3-2. The prime mover for the system is used to maintain a minimum flow of water through the ejector, which in turn exerts a negative pressure or suction on the ground water present in the well. The momentum transfer that occurs within the ejector's venturi assembly imparts a vacuum of sufficient strength to induce flow out of the well and into the collection piping.

This type of ground water extraction system is reliable, cost effective, does not require complicated controls. To facilitate system operations and monitoring, RMT has found it useful to include flow meters, check valves, and throttling valves at select locations throughout the system. A general process flow diagram for the jet pump ground water extraction system at the Medley Farm Site presented in Drawing 938-C04.

#### ***Recirculation System***

The dual jet pump extraction systems for the Medley Farm remediation will hereinafter be referred to as System A and System B, respectively. As you examine the Process Flow Diagram (PFD), you will note that both System A and B are each provided with a dedicated centrifugal pump. Each of these two systems share a central recirculation tank shown on the PFD. This central recirculation tank serves as the point of suction for both prime movers and provides the water supply necessary to maintain the minimum water flow throughout each of the respective ground water recovery systems.

The base water supply for systems A and B, plus the recovered ground water from each extraction well eventually returns to the recirculation tank, where each of the prime movers renews the cycle. As the water level increases in the recirculation tank, there is an overflow through which excess water flows by gravity to the surge tank for pumping to the air stripper.

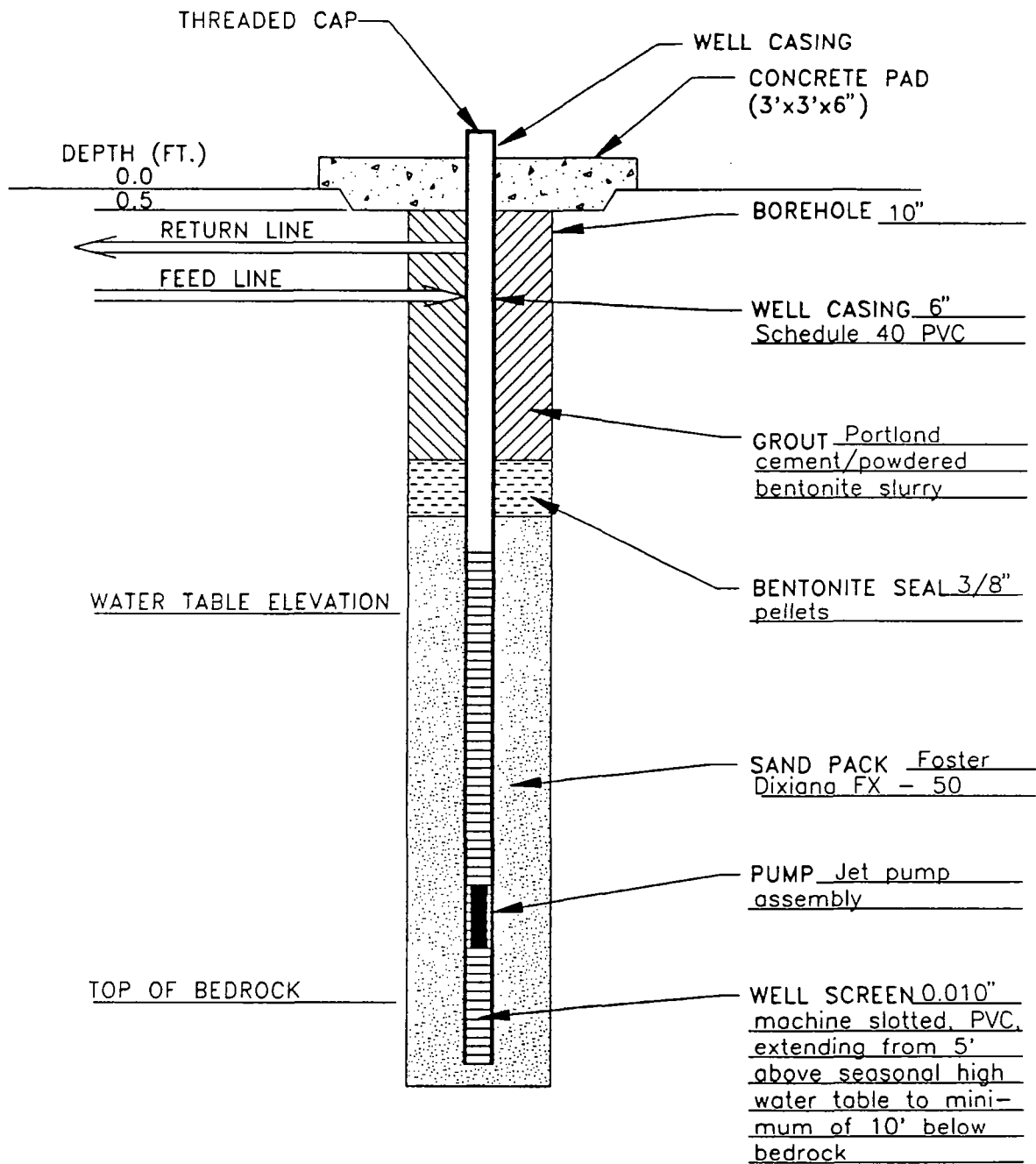


FIGURE 3-2  
GROUND WATER EXTRACTION WELL CONSTRUCTION SCHEMATIC  
Not To Scale

The recirculation tank is sized to accommodate approximately 150 percent of the total required volume of water necessary to maintain minimum flow within Systems A and B. A level sensor is used to monitor the water level within this unit to ensure that the tank does not overflow. In the event of a high water alarm, a signal is transmitted to the central control panel, which then disrupts the power supply to one or both of the prime movers, effectively shutting the system down.

*Need low level alarm to shut down centrifugal pumps if system goes dry (i.e. line rupture) to keep bearing from melting.*

#### Surge Tank

Excess ground water overflows the recirculation tank and is collected in the Surge Tank. This tank serves as the source of suction head for the booster pump that lifts the extracted ground water into the air stripper. The booster pump is controlled by a level sensor in the tank that monitors the volume of water in the tank. As the water level in the tank increases, a signal is sent to turn on the booster pump and air blower for the air stripper. This pump will then transfer water from the tank to the top of the air stripper. As the level within the surge tank decreases below a preset minimum, the pump and blower are shut off. A high level alarm in this tank will similarly initiate a shut down of the centrifugal pumps for System A and B, the booster pump, and the air blower.

#### Air Stripper

The air stripper booster pump lifts the extracted ground water to the top of the air stripper unit. Once here, the water flows across the upper distribution plate of the air stripper where it is uniformly distributed over the internal packing media of the air stripper by a series of spray nozzles. The extracted ground water then drains by gravity through the packing media to a sump located at the bottom of the air stripper. As the extracted ground water passes downward, an air stream is forced upward through the ground water by a blower.

*packing and*

This counter-current flow of extracted ground water and air induces mass transfer of VOCs from the ground water and into the air stream. This counter-current action strips the VOCs from the water phase and introduces them to the air phase. Treated ground water will flow by gravity from the air stripper through a discharge line to the NPDES outfall on Jones Creek.

*NO BACKUP, OR multiple units - -  
NO GAC  
polisher*

### **3.2.2 Soil Vapor Recovery System**

Soil vapor recovery will be used to remediate unsaturated zone (vadose zone) soils in three areas designated by the Record of Decision (ROD) and shown on Drawing 938-C05. These areas of the site were identified during the RI/FS as having the potential to provide a long term source of VOC to the ground water.

#### ***Soil Vapor Extraction (SVE) Wells***

A series of vapor extraction wells will be installed within each area described by the ROD and piped to a central vacuum pump by way of a common header. A preliminary arrangement for this system is shown on Drawing 938-C05. Figure 3-1 also depicts the general manner in which the vapor extraction wells interact with the ground water extraction wells. Soil vapor extraction wells will generally be installed ten feet above the mean high ground water elevation. A typical construction diagram for a soil vapor extraction well is shown on Figure 3-3.

Soil vapor extraction wells will be constructed using two-inch schedule 40 PVC piping. The screened interval for these wells will be approximately ten feet above the mean high water elevation to the surface. The screens for the soil vapor pumping wells will be 0.010-inch continuous slotted.

Preliminary calculations indicate that a system of 18 soil vapor extraction wells may be necessary to conduct the required vapor extraction operations in the three areas designated by the ROD. Treatability testing will be conducted during the Winter/Spring of 1993 to confirm this preliminary design basis. Preliminary calculations also indicate that a single vacuum system will be adequate to induce the required air flow from the soils. The process flow diagram for this system is shown on Drawing 938-C04.

Generally, the vapor extraction wells are piped into a central header which is piped to the vacuum unit. The piping is run along the surface of the ground, since freezing is not a consideration for pipelines conveying an air stream. As a vacuum is applied to the site soils, recovered vapors flow through a four-inch pipe header, into the vacuum unit and are then discharged to the atmosphere.

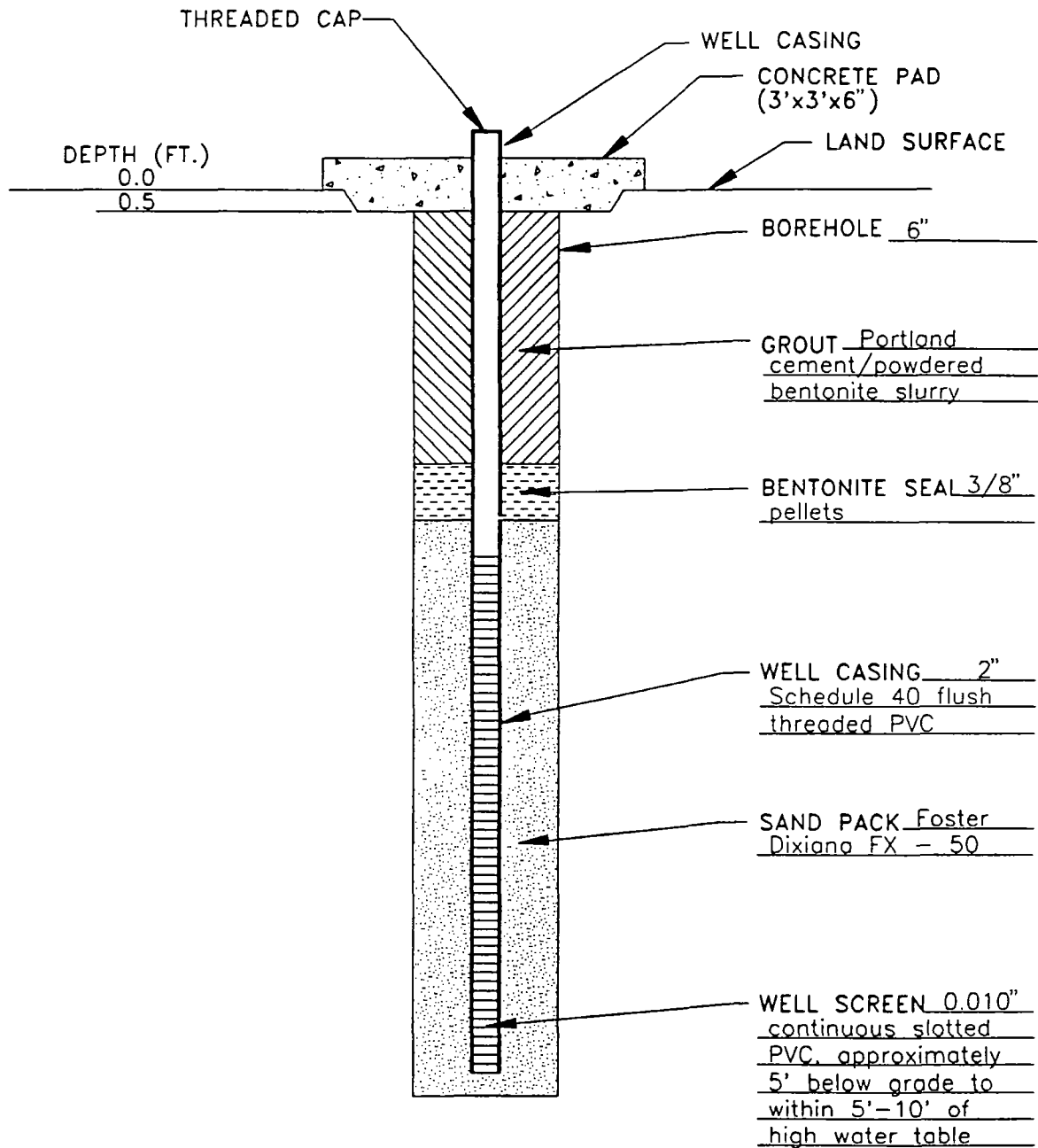


FIGURE 3-3  
SOIL VAPOR EXTRACTION WELL SCHEMATIC  
Not To Scale

The vacuum unit to be utilized for the Medley Farm Site remediation will be pre-engineered, prefabricated, skid-mounted, and piped and wired to the degree dictated by site conditions. The major components of this system are described, below.

#### ***Condensate Trap***

Prior to entering the vacuum unit, extracted vapors will first pass through a condensate trap. The purpose of this unit is to remove entrained water vapor from the air stream before it passes through the vacuum pump. Water will collect in the bottom of this trap as time progresses. A drain will be manually opened to periodically remove this water from the SVE system. This water can be periodically discharged to the surge tank of the air stripping unit for treatment prior to discharge to the Jones Creek NPDES outfall.

#### ***Air Filter***

The air vapor will then pass through a high efficiency particulate filter to remove fine particle solids prior to their entry into the vacuum unit. Pressure gages located upstream and downstream of the unit will be used to monitor the pressure drop across the filter.

#### ***Air Intake***

Make-up air is provided through a filtered air intake. A globe valve is positioned on this line to precisely regulate the amount of make-up air that is bled into the system. A flow meter and pressure gage are situated upstream of this globe valve to monitor intake conditions. Make-up air is necessary for starting the vacuum system under no-load conditions and to operate the vacuum levels at variable levels of system efficiency.

#### ***Inlet/Discharge Silencers***

In-line silencers are installed on both the inlet and discharge side of the vacuum pump. Vacuum pumps of the size used for SVE are typically quite noisy and these silencers are used to reduce the noise level during site operations. RMT will also be assessing the possible need for an enclosure to further reduce the noise-level of the SVE system.

### ***Vacuum Pump***

The vacuum pump will be a rotary globe, positive displacement pump capable of providing 1,500 SCFM under no load conditions, and capable of operating up to a vacuum of 120 inches of water (8.8 inches mercury).

A vacuum relief valve is located immediately upstream of the pump. A temperature sensor is located immediately downstream of the pump. If discharge temperature exceeds normal operating temperature, the temperature sensor will transmit a signal to the control panel and pump operation will cease. A high level signal from the liquid level sensor in the condensate trap will also cause the vacuum pump to shut down. A temperature indicator and a pressure gage on the discharge piping allow for monitoring the physical condition of the discharge stream.

### ***Discharge Stack***

Recovered soil vapors and make up air will be discharged to the atmosphere through a 15-foot high discharge stack. The materials of construction for this stack will be defined by the discharge temperature of the exhaust stream. A sample port will be located at the base of the stack for sampling the discharge stream.

## **3.3 Project Delivery Strategy**

The general project schedule for the Medley Farm Site Remedial Design was first presented in Section 5 of the Remedial Design Work Plan. This RD schedule established RMT's time-frames for providing the required project deliverables and made assumptions regarding the time required for US EPA and SC DHEC reviews.

Following US EPA approval of the RD Work Plan, RMT submitted a detailed delivery schedule for all RD documents in a September 8, 1992 letter to the US EPA. The delivery schedule for the Medley Farm RD documents was based upon the following deadlines:

<u>DESIGN ACTIVITY</u>	<u>PLANNED DURATION</u>	<u>DELIVERY DATE</u>
1) Submit Preliminary Design	2.5 Months	November 20, 1992
2) Receive US EPA Approval	1.5 Months	December 31, 1992
3) Submit Prefinal Design	5.0 Months	May 28, 1993
4) Receive US EPA Comments	1.5 Months	July 9, 1993
5) Submit Final Design	1.5 Months	August 27, 1993

With the exception of the Preliminary Design submittal, this schedule of design deliverables was predicated upon receipt of Agency comments/approvals within the allotted 1.5 month time-frame. The submission dates for both the Prefinal and Final Design packages were thus agreed to be contingent upon receipt of US EPA and SC DHEC comments/approvals by the specified dates.

This Preliminary Design Submittal constitutes the first deliverable under this schedule. The delivery schedule for the remaining project deliverables is now predicated upon the planned duration for each remaining design activity and the date Agency comments to the prior deliverable are received.

RMT has proposed conducting two ground water pumping tests and a minimum of three soil vapor extraction tests prior to finalizing the design for each of these systems. There will also be some limited testing of the surface water from Jones Creek and the site ground water for evaluation of proposed NPDES permit limits, and scaling/corrosion considerations. With Agency approval, we would conduct these tests during the first quarter of 1993. These tests should not affect the final delivery dates set forth above.

### **3.4 Design Criteria**

The Statement of Work (SOW) for the Medley Farm RD/RA specifies that the design criteria for the project must be prepared and submitted for Agency review as a part of the Preliminary RD submittal. The design criteria that have been provided in Section 3.4.1 through 3.4.12 are submitted in response to this SOW requirement. These design criteria are intended to outline and describe the major design, operational, and maintenance considerations that have been used as the basis for design of the ground water and SVE treatment systems. These design criteria have been developed to address the

technical and regulatory issues and objectives defined by the US EPA's ROD and SOW developed for the Medley Farm Site.

These design criteria provide the foundation for development of the facilities necessary for implementation of the ROD-selected remedy and are based on RMT's current knowledge and understanding of site conditions as they existed at the time of this report's preparation. The design criteria set forth in this section may be modified, on an as-needed basis, in response to technical considerations arising from field treatability studies, changes in observed hydrogeological characteristics, and observed deviations from previously defined site conditions.

#### 3.4.1 Applicable Codes, Standards, and Regulations

RMT is aware of no applicable building codes which affect the design of the SVE and ground water treatment systems described herein. All facilities described in this document are to be designed and constructed in accordance with applicable regulations set forth by the South Carolina Department of Health and Environmental Control (SC DHEC), and affected Cherokee County Agencies. Furthermore, all design work is to be conducted in accordance with requirements set forth in the Record of Decision, Consent Decree, and Statement of Work jointly negotiated and agreed to by the Medley Farm Site Steering Committee (Steering Committee) and the US EPA and SC DHEC.

#### 3.4.2 Horizontal and Vertical Controls

Horizontal and vertical controls for the site were set during the course of generating the site topographic map used during the RI/FS. Survey monuments used during the RI/FS will also be used for lay-out and construction of the new facilities described herein. These survey monuments include the following provided in Table 3-1:

*Building permit is part of NPDES permit process (for treatment plant)*

**TABLE 3-1**  
**HORIZONTAL AND VERTICAL CONTROLS**

<u>Monument Description</u>	<u>Coordinates</u>		<u>Elevation</u>
	<u>Northing</u>	<u>Easting</u>	<u>(Ft Above MSL)</u>
#10	9406.9	7136.7	—
#13	88489.0	7677.3	—
SW-4 (Top of Casing)	—	—	671.39

#### 3.4.3 Earthwork

- The major source of earthwork for this project will be access road construction, grading around the pump pads, and excavation/backfill for underground piping and valve pit installations.
- Slopes excavated during access road construction shall not be steeper than 2:1 (horizontal:vertical).
- Diversions created as a part of this excavation shall maintain a slope of greater than one percent to selected discharge points. Refer to Section 3.4.5 Storm Drainage for more information on access road diversions.
- If fill material is to be placed on slopes greater than 4:1 (horizontal:vertical), the receiving slope shall be benched to ensure the stability of the embankment.
- A stability analysis shall be conducted, using currently available site data, to determine adequate bench dimensions.
- Fill materials shall be placed at a minimum density of 95 percent standard proctor at optimum moisture content.
- Earthwork around the pump pad shall be completed to provide a proper foundation for the slab and ensure positive drainage away from the facility.
- Trenching activities shall be done in accordance with OSHA requirements. Bedding materials shall be sand or washed stone compatible with the selected pipe material.
- Trench backfill shall be compacted to a minimum of 95 percent standard proctor at optimum moisture content.

#### **3.4.4 Roads**

Site roads will meet the following minimum requirements:

- Site access roads shall be limited to a maximum eight percent grade.
- Access roads shall have a minimum width of 15 feet to facilitate movement of drilling/trenching equipment, construction traffic, and maintenance vehicles during construction and site operations.
- Recommended construction of site access roads should consist (at a minimum) of a geotextile underlayment (MIRAFI 600 or equivalent) followed by a crushed stone cover (minimum depth of six inches) to minimize long-term maintenance.

#### **3.4.5 Storm Drainage**

Storm drainage features for this project include access road diversion ditches, access road culverts, diversions around the pump pad, and a level spreader to disperse the water collected by the pump pad diversions. Storm drainage features will meet the following requirements:

- The design storm event for all storm drainage structures shall be the 10 year/24 hour event.
- All facilities will be checked against the 25 year/24 hour event.
- For Cherokee County, South Carolina, the ten year/24 hour storm event is approximately 5.1 inches of rainfall and the 25 year/24 hour storm event is approximately 5.9 inches of rainfall.
- Access road diversion ditches shall have a minimum slope of one percent and a maximum slope of eight percent.
- Velocities within these ditches shall be limited to four feet per second or less, without a protective lining (either matting or riprap).
- Culverts will discharge water from these ditches to the Jones Creek side of the access road.
- Culverts will be spaced to limit ditch velocities and culvert discharge velocities.
- The minimum culvert slope shall be one percent.
- Velocities in the culvert discharge channels to Jones Creek shall be held as low as practicable.

- Pump pad diversions shall have a minimum slope of one percent. These diversions shall not constitute major drainage control features, but shall be used to promote positive drainage in the area immediately adjacent to the pump pad.

#### **3.4.6 Erosion Control**

All site activities are designed and conducted in accordance with Cherokee County erosion control ordinances and regulations, and will meet the following requirements:

- Erosion control measures are to be utilized during construction shall consist of filter fabric silt fences placed downhill of construction activities, rock check dams spaced evenly in newly constructed diversions, and hay bales (wherever specified).
- Permanent erosion controls will consist of an erosion control mat placed, when necessary, on a slope or in a ditch to hold soil in place until a suitable vegetative root system can be established that will hold the soils in place. This mat may consist of either wood fiber or geosynthetic materials.
- Rip-rap or other suitable armoring methods may be utilized, depending upon the ditch/culvert velocities encountered.

#### **3.4.7 Ground Water Extraction Wells**

##### ***Modelling Evaluation***

- The initial location of ground water pumping wells will be based upon Capture Zone analyses using the US EPA's Well Head Protection Model (GPTRAC Module).
- Initially, RMT intends to conduct single well pumping tests at monitoring wells SW-4 and SW-108. These pumping tests will be conducted on existing two-inch monitoring wells. The purpose of these tests is to better assess the saturated thickness of the aquifer and the hydraulic conductivity at these key locations. The saturated thickness of the aquifer and hydraulic conductivity are key input parameters for the Capture-Zone Model.
- The Capture Zone model will then be used to identify locations for three permanent six-inch pumping wells. These pumping wells will be installed during the Spring of 1993 for the purpose of conducting formal pumping tests which will, in turn, provide the necessary data for development of a site-wide ground water flow model. The proposed location for these first three ground water extraction wells are depicted on Drawing 938-C03.
- Formal pumping test analyses will be conducted on pumping wells A-4 and B-4 that are to be located near existing wells SW108/BW108 and SW-4, respectively. The third pumping well (A-1) will be temporarily utilized for additional water quality and water table measurements until such time as it is placed into service.

- The results of the pumping tests conducted on wells A-4 and B-4 will then be used to calibrate a site ground water flow model (MOD-FLOW) to be used as a guide for tracking the overall effectiveness of the ground water capture/containment system, as addressed by the objectives of the ROD and SOW.

#### ***Locations***

- Using the US EPA's "Capture Zone" model, preliminary locations for eight ground water extraction wells have been developed and are shown on Plate 3.
- Ground water extraction wells will be installed to a minimum depth of ten feet within competent bedrock, as defined by the hydrogeologic properties of the rock encountered. This means that bedrock must exhibit fractured media flow characteristics before it will be considered competent rock. Weathered bedrock that continues to exhibit porous media flow characteristics will be treated similar to the overlying saprolite.
- Extraction wells will be installed using a combination of air rotary and diamond coring drilling techniques.
- Extraction wells will be constructed of six-inch Schedule 40 PVC.
- Extraction wells will be screened from the bottom of the borehole to approximately five feet above the observed water table. All well screens will be 0.01-inch machine-slotted.
- All downhole construction materials will be threaded, flush-joint PVC.
- Feed and return lines to extraction wells will be constructed below grade to minimize opportunities for possible vandalism. Pitless adapters will be used to make the construction connection (per Drawing 938-C12).

#### ***Basis for Sizing***

- Ground water extraction wells will be constructed as six-inch wells (minimum) to facilitate installation of the jet-pump assemblies.
- Schedule 40 PVC materials of construction for casing and screens.
- Screen slot size to be 0.010 inch.
- Well construction is described by Figure 3-2.

### 3.4.8 Ground Water Extraction System

#### *Piping*

- Piping for the ground water extraction systems will consist of a circulating system which will convey water to/from jet pumps to be installed within each permanent pumping well.
- Piping along the main loop will be sized to minimize friction losses.
- The main piping loop will also be sized to accommodate the installation of 50 percent more extraction wells than will be called for as a result of the Final Design Report.
- Refer to Section 3.4.3 Earthwork for additional details regarding trenching, bedding, and backfilling requirements.
- Underground pipes shall have a minimum of three feet of cover.
- Pipe materials to the pumping wells shall be Schedule 80 Polyvinyl Chloride (PVC).
- Piping materials within the pumping wells shall be Schedule 80 PVC and an industrial hose material, specified on the design drawings. The industrial hose material shall be PVC with a synthetic, high tensile cord reinforcement (rated to a maximum water pressure of 250 psi and having a minimum nine-inch bending radius).
- Exposed piping, pumps, and valves shall be heat traced and insulated to minimize freezing during winter operations.
- Thrust blocks for the system will be designed based upon a specified test pressure of 225 psi.
- Piping taps shall be installed at intermittent locations to facilitate temporary clean-outs or chemical additions.

#### *Jet Pumps*

- Jet Pumps shall be sized to extract the desired flow from each of the pumping wells. The pressure required at each jet pump shall be minimized to produce the desired ground water recovery rate.
- Jet pumps shall be designed to push the design flow against the maximum head from the respective jet pump location to the recirculation tank, with a net positive suction head of zero.
- The jet-pump assembly will be installed at the theoretical depth of maximum draw-down as established by ground water modelling efforts such that the net suction head is zero.
- The required design flow for each jet pump venturi will be established as a result of ground water modelling efforts.

### ***Valves and Meters***

- Valves and meters shall be rated at 150 psi service and shall be brass or carbon steel.
- Globe valves will be used for those applications requiring flow control.
- Ball valves will be used for those applications requiring system isolation.
- Meters shall be located a minimum of ten pipe diameters from the nearest valve.
- A recorder shall send flow data to a centrally located display panel, which shall provide the operator with a total flow into and out of each pumping well.
- Strainers shall be installed on the suction side of all pumps to guard against possible damage from larger solids inadvertently introduced into the system.
- Valve and meter pits shall be a minimum of 3 ft. X 5 ft. to facilitate construction and/or maintenance activities.
- Water level measurements are to be provided for each extraction well.

### ***Pump Stations***

- A separate pumping system will be used to operate each leg of the ground water extraction system (labelled as Systems A and B on the drawings).
- An additional System C is shown on the drawings for possible use in the future should the need be identified.
- The pumps for these systems shall be horizontal centrifugal pumps rated for continuous service.
- Each of these pumps shall be sized to pump the total flow required to achieve the desired ground water extraction rate, any additional incremental flow recovered from each well, and a minimum circulating flow of 25 gallons per minute.
- Worst-case analysis will be used to calculate the maximum head each pump must overcome to deliver the required flow at the required pressure.

### ***Tanks***

- The recirculation tank for the pumps shall be sized to hold 150 percent of the total volume of piping anticipated to be in service.
- Tanks shall be constructed of steel, fiberglass, HDPE plastic or other suitable material submitted to and approved by the Engineer.
- Tanks will have tops and be opaque to light to limit algal growth.

#### ***Pump Pad***

- Pumps, tanks, air blower, and air stripper shall be located on a concrete pad centrally located with respect to the ground water plume and Jones Creek.
- The pad must be sized to accommodate future expansion or equipment additions.
- Pad shall be designed using a soil bearing pressure of 2,000 pounds per square foot.
- Pad surface shall receive a broom finish and be sloped uniformly at 0.25 inch per foot to promote drainage.
- Concrete shall be a minimum 3,000 psi mix and have reinforcing steel of adequate size and spacing for the specified loading conditions and soil strength.
- Pad shall be surrounded by a six-foot security fence topped with three-strands of barbed wire.

#### **3.4.9 Soil Vapor Extraction System**

##### ***Extraction Wells***

- Two-inch vapor extraction wells are to be utilized at locations described in Drawing 938-C05.
- Construction details for SVE wells are provided in Figure 3-3.
- Schedule 40 PVC materials of construction for casing and screens.
- Screen slot size to be 0.010 inch.
- SVE wells to be screened through the unsaturated soil zone to no closer than ten feet of the seasonal high water table.
- SVE wells to be installed using air-rotary drilling techniques.
- SVE wells have been initially spaced on 40 foot centers within areas specified by ROD.
- In-place testing of SVE wells VE-101 and VE-301 to be conducted prior to development of prefinal/final design configuration. This testing will involve installation and monitoring of the influence radius for these wells to confirm the overall basis for design of the remaining SVE wells.

##### ***Vacuum Monitoring Wells***

- One-inch vacuum monitoring wells are to be utilized at locations described on drawing 938-C05.

- Construction details for VMWs are provided in Figure 3-4.
- The materials of construction to be used for VMWs will consist of Schedule 40 PVC casings and screens.
- VMW screen slot size to be 0.010 inch.
- VMWs are to be screened in the unsaturated soil at intervals to be specified in the field. The maximum depth of any VMW well may be within ten feet above the seasonal high water table.
- VMWs are to be installed using air-rotary drilling techniques.
- VMWs are to be used during testing conducted during pre-final/final design phases. This testing will involve installation and monitoring of the influence radius at various depths and locations of a SVE well to confirm the overall basis for design of the remaining SVE wells.

#### ***Vacuum Piping***

- Piping for the SVE system will consist of two-inch PVC piping leading from each of the vacuum extraction wells to the central four-inch pipe manifold lines. The main pipe manifold lines will convey soil vapor from each of the three SVE well fields to the centrally located vacuum unit.
- SVE manifold piping will be sized to accommodate the installation of 50 percent more SVE wells than are called for as a result of the final Design Report.
- Vacuum piping and manifold lines to be constructed of Schedule 40 PVC.
- Vacuum lines to be installed on surface and socket-cement welded.
- Condensate trap and filter to be utilized ahead of vacuum pumps to protect unit from water/particulate debris.
- Sun screens or UV inhibitors shall be employed to minimize long-term oxidation of exposed plastic parts.

#### ***Vacuum Pumps***

- Sizing of the vacuum pump will be based on the results of field testing using a two-inch SVE well and several one-inch vapor monitoring wells. This field testing will include monitoring of SVE well yield, system vacuum, and the observed radius of influence.

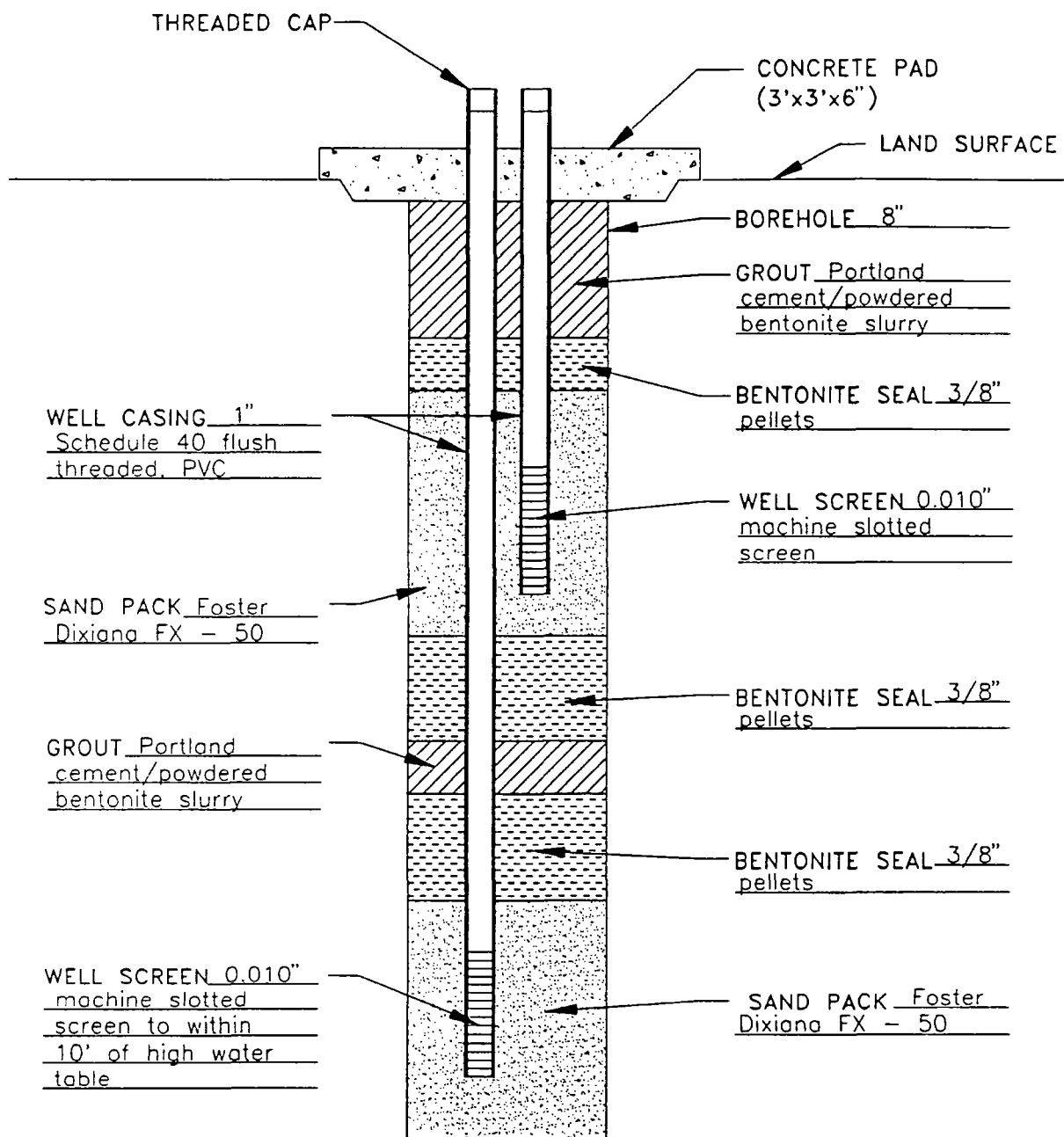


FIGURE 3-4  
VACUUM MONITORING WELL SCHEMATIC  
Not To Scale

- The vacuum pump will be sized to deliver 175 percent of the combined SVE well yields at the design vacuum. The combined extraction well yields is equal to 18 times the optimum well yield obtained during the in-place testing.
- The design vacuum is equal to 115 percent of the vacuum under which the optimum well yield during the in-place testing was achieved, plus a design factor to account for system and piping losses. At a minimum, the SVE system will be operated at a vacuum of approximately 100 inches of water.
- A vacuum relief valve will be located immediately upstream of the vacuum pump and will fully open at a vacuum of no greater than 110 percent of the design vacuum. The vacuum relief valve shall be sized to provide 100 percent of the process air at a fully open position.
- Silencers are to be provided on air inlets and outlets to minimize noise. The silencers are to be combination chamber, absorptive type silencer with a double shell construction.
- Positive displacement vacuum pumps to be used. Rotary globe type as manufactured by Roots, Sutorbilt, or similar.
- Requirements for additional noise abatement measures to be evaluated during design.

#### ***Monitoring Systems***

- Sample ports to be provided on inlet and outlet sides of vacuum pump(s).
- Vacuum gages to be provided on inlet piping and air intake line.
- Pressure gages to be provided on discharge piping.
- A temperature indicator is to be provided on discharge piping.
- Air flow meters to be supplied on inlet piping and air intake line.
- Vacuum monitoring wells to be utilized in field to establish radius of influence of SVE wells.

#### **3.4.10 Air Emissions**

##### ***Process Design***

*The process design for air emission controls is not applicable at this time*

### 3.4.11 Ground Water Treatment and Discharge

#### *Process Design*

- The air stripping tower shall be of the forced draft type using a counterflow ambient air stream to affect the removal of dissolved volatile organic compounds from the ground water.
  - The air stripping tower shall be capable of treating water at flow rates up to 100 gpm. Incoming water will be extracted ground water at a temperature of 16 to 18° C.
  - The air stripping tower will be designed for outdoors installation and to withstand a design wind load of 100 miles per hour.
  - The air stripping tower shall be prepped and prewired to the degree most practical for ease of installation.
  - The air stripping tower shall be provided with all necessary process connections including but not limited to the following:
    - water inlet \*
    - water discharge \*
    - stripping air inlet \*
    - level transmitter
    - level switch
    - centrifugal air blower\*
    - air flow transmitter
- \* Sizing of these units/connections to occur during pre-final design.
- Water is to enter the top of the air stripping tower through a corrosion resistant distributor designed to evenly distribute the water across the area of the tower's packing. The water distributor may be a full cone spray nozzle or a pipe header with orifices. Full load pressure drop across the water distributor must not exceed five psi.
  - The air stripping tower shall utilize a single column of random packing or structured packing material designed by the manufacturers to efficiently remove VOCs from ground water.
  - The packing material will be supported within the tower on a support grid(s) designed to pass air and water without flooding, pooling or excessive pressure drop.
  - Liquid redistributors (wall wipers) shall be provided in the event the packed column height exceeds ten feet. Redistributors will be spaced evenly throughout the column at a distance no greater than ten feet.
  - One centrifugal air blower will be required to provide air to the base of the tower. The blower is to be direct or belt driven by an electric motor suitable to the available power supply.

- The air blower will be provided with all guards necessary to shield belt and/or drive from operator.
- An air flow switch shall be provided on the blower discharge housing.
- A demister shall be located at the top of the tower.
- The initial sizing of the air stripping column will be based on removal efficiency analysis developed using to Airstrip® design package used for the design of counter current packed towers.
- Representative VOC concentrations for the influent ground water stream will be developed and used as data input for the Airstrip® model. These concentrations will be based on the VOC concentrations observed in the site ground water during the four quarterly sampling events of 1992.
- VOC concentrations in the air stripping effluent stream will be designed to meet Water Quality Criteria (WQC) limitations established for the NPDES permits. These limits have not been developed, but are pending. In the event WQC limits are lower than instrument detection limits, then the system discharge limits shall be based on the available laboratory detection limit. Table 3-2 summarizes the most current VOC influent and effluent concentrations that are available for design purposes.

#### ***Instrumentation***

- Instrumentation panels to be designed for outdoor service (NEMA 4 or higher).
- Centralized control/monitoring panel to provide equipment status, flow, and operating data for operator use.
- Continuous recording and totalizing of NPDES discharge to Jones Creek is required.
- Low/high level interlocks required for tanks and treatment equipment.

#### **3.4.12 Electrical**

The electrical requirements for this project will meet the following requirements:

- Power line separate from property owners to be brought in.
- Overhead power distribution to be used.
- Security lighting to be provided on designated power distribution poles.
- All electrical and power supply equipment to be designed for outdoor service (NEMA 4 or higher).

**TABLE 3-2**  
**PRELIMINARY DESIGN VOC INFLUENT AND EFFLUENT CONCENTRATIONS**

VOLATILE ORGANIC COMPOUND	HIGHEST OBSERVED VOC CONCENTRATIONS (ppb)	MONITORING WELL NUMBER	DESIGN EFFLUENT CONCENTRATION (ppb) <sup>a</sup>	REQUIRED REMOVAL EFFICIENCY (%)
Benzene	2	BW108	1.2	40.0
Chloroform	9	BW108	5.7	36.7
1,1 Dichloroethane	5	BW108	350	NA
1,2 Dichloroethane	650	BW02	0.50	99.92
1,1 Dichloroethene	400	BW02	0.57	99.88
1,2 Dichloroethene (Total)	37	BW108	70	NA
Tetrachloroethene	560	BW108	5	99.1
1,1,1 Trichloroethane	61	BW108	200	NA
Trichloroethene	920	BW108	2.7	99.7

- a Design effluent concentrations are based on US EPA Freshwater Chronic Aquatic Toxicity values and lowest Practical Quantitation Limits (PQL) for those organic compounds having aquatic toxicity values below the PQL
- NA Not Applicable

- Instrumentation will be provided to permit inspection of system operation by operator from single control panel.
- Control logic will be developed to minimize required time on-site by operator.
- Instrumentation (lights, annunciators, etc.) will be provided to assist operator in quickly identifying problems that initiate system shut-down.

### 3.5 Permitting Strategy

#### 3.5.1 NPDES

RMT's approach to obtaining the necessary NPDES permit during the remedial design will occur in two distinct phases. Phase 1 involves completion and submittal of EPA Form 2D (New Sources and New Dischargers: Application For Permit to Discharge Process Wastewater) to SC DHEC for review. In this phase of the permitting process, RMT will develop estimates of the anticipated rate of discharge from the ground water treatment system and the chemical characteristics of the treated ground water. SC DHEC personnel have indicated that preliminary discharge limitations for applicable COCs would be available within 8 weeks of this submittal.

At this time, RMT will evaluate the feasibility of achieving the proposed discharge limitations using the treatment processes prescribed by the ROD. Discharge of treated ground water to Jones Creek has long been recognized as the only cost-effective alternative, but other alternatives may have to be considered if restrictive water quality criteria are applied as proposed discharge limits. In the event this situation occurs, RMT will advise the US EPA and identify other discharge alternatives.

Phase two of the NPDES permit process will be completed within two years following start-up of the ground water treatment system. As actual discharge of treated ground water begins, the treated effluent from the system will be sampled and analyzed for the parameters necessary to complete US EPA Form 2C. This permit package, along with the necessary technical documentation, will be submitted for SC DHEC/US EPA review. After submittal of this package, RMT anticipates a period of discussion and negotiations with SC DHEC which will ultimately result in the issuance of a NPDES permit for the ground water remediation system.

RMT's Pre-Final and Final Design submissions to the US EPA and SC DHEC will be formatted in such a manner as to meet both the requirements of the Consent Decree and SC DHEC requirements for submissions leading to issuance of construction and operating permits for the treatment system. Documents will be prepared under the direction and supervision of a South Carolina-registered engineer.

### 3.5.2 Air Quality

RMT's preliminary evaluations of expected air emissions from the air stripper and soil vacuum extraction units leads us to believe that Medley Farm falls into a de minimis category and air permits will not be required. RMT has addressed this issue by preparing two alternatives for submittal to the SC DHEC Bureau of Air Quality Control (BAQC) to meet their requirements for construction and operating permits. First, RMT has prepared a technical justification for de minimis emissions and a request for waiver of air permitting requirements. RMT's request for a permitting waiver includes VOC emissions estimates previously compiled by SEC during the RI/FS, modelled ambient air concentrations, specific equipment details for both the air stripper and SVE system, and other supporting technical documentation. This information will be transmitted to Mr. Robert Wood of SC DHEC BAQC with a copy of this preliminary design document for back-up. This waiver request is in accordance with recent SC DHEC policy developed for SVE and air-stripping systems of this type. We believe that, after review and consideration of our technical submittal, SC DHEC BAQC will grant our waiver request for this project.

In the event that the BAQC should decide not to grant the waiver request, RMT would submit an application to construct and operate air polluting devices. SC DHEC BAQC typically requires that applications for construction be submitted at least 90 days prior to the anticipated date of construction. The permit application would include the Part I-General Information Application, Part IIB-Process Permit Application and the Modelling/Air Toxics questionnaire. Following review of this permit application and satisfaction of possible BAQC concerns, the BAQC would then issue the required Permit to Construct, with any applicable air quality restrictions.

The Operating Permit will be issued once the construction of the various treatment units is complete and normal operations begins. BAQC typically requires a letter prior to start-up operations, stating that the units are complete and the date that normal operations will initiate. At that time, BAQC may elect to send an inspector to verify construction of the units in accordance with the permit application prior to issuance of the Operating Permit. RMT anticipates conducting limited field trials of SVE well(s) at the site to obtain more detailed information regarding expected air emissions from the SVE system.

In either event, RMT believes that the SC DHEC BAQC will not require installation of air pollution control equipment for either of these remediation devices as specified by the ROD. Currently, there has been no requirement for similar remediation equipment operating in South Carolina to be retrofitted with such air pollution control devices.

### **3.6 Preliminary Plans and Specifications**

#### **3.6.1 Preliminary Drawing List**

At this time, the following drawings are anticipated for the Medley Farm Remedial Design. Due to the preliminary nature of this submittal, several of these drawings have not yet been prepared. Following incorporation of the preliminary Agency comments into the project design criteria, these drawings will be initiated and provided with the Pre-Final Design Report.

<u>DRAWING NUMBER</u>	<u>DRAWING TITLE</u>
938-C01	TITLE SHEET
938-C02	EXISTING SITE CONDITIONS
938-C03	GENERAL ARRANGEMENT - GW TREATMENT SYSTEM
938-C04	PROCESS FLOW DIAGRAMS
938-C05	GENERAL ARRANGEMENT - SOIL VAPOR EXTRACTION SYSTEM
938-C06	GRADING & DRAINAGE PLAN - SYSTEM A
938-C07	GRADING & DRAINAGE PLAN - SYSTEM B
938-C08	UNDERGROUND PIPING PLAN - SYSTEM A
938-C09	UNDERGROUND PIPING PLAN - SYSTEM B
938-C10	PUMP PAD SECTIONS & DETAILS
938-C11	SOIL VAPOR EXTRACTION SYSTEM DETAILS
938-C12	MISCELLANEOUS DETAILS

### 3.6.2 Preliminary Specification List

The following specifications are anticipated for the Medley Farm Site Remedial Design. Due to the preliminary nature of this submittal, it is possible that some of the specifications listed below may change.

<u>CSI SPECIFICATION NUMBER</u>	<u>SPECIFICATION TITLE</u>
02071	MONITORING WELL PROTECTION
02102	CLEARING AND GRUBBING
02220	EXCAVATION AND BACKFILL
02250	SOIL COMPACTION CONTROL AND TEST
02270	EROSION CONTROL
02444	CHAIN LINK FENCE
02512	CRUSHED STONE PAVING
02726	UNDERGROUND PIPING SYSTEMS (PRESSURE)
02931	SEEDING
02935	FERTILIZING
16010	CONTROL PANELS
16011	MOTOR TESTING
16111	CONDUIT
16123	WIRE AND CABLE
16170	GROUNDING
16195	ELECTRICAL IDENTIFICATION
16421	UTILITY SERVICE
16426	DISTRIBUTION SWITCHBOARD
16441	ENCLOSED SWITCHES
16670	LIGHTNING PROTECTION
16855	HEATING CABLES

#### **Section 4**

#### **PRELIMINARY SCHEDULE FOR IMPLEMENTATION OF REMEDY**

The following preliminary construction schedule is provided for US EPA and SC DHEC review and information only. The time-frames provided in Plate 4 are not intended to be enforceable under the Medley Farm Consent Decree, but rather as a guideline for reviewer's use. The Remedial Action Work Plan, scheduled for submission to the Agency following approval of the Final Remedial Design submittal, will contain the final construction schedule that will be enforceable under the provisions of the RD/RA Consent Decree.

# SDMS

## Unscannable Material Target Sheet

DocID: 4284 Site ID: SCD980588142

Site Name: MCDLEY Farms BOX 6 of 13

### Nature of Material:

Map: ✓

Computer Disks: \_\_\_\_\_

Photos: \_\_\_\_\_

CD-ROM: \_\_\_\_\_

Blueprints: \_\_\_\_\_

Oversized Report: \_\_\_\_\_

Slides: \_\_\_\_\_

Log Book: \_\_\_\_\_

Other (describe): \_\_\_\_\_

Amount of material: 1 MAP OF REMEDIAL ACTION PRELIMINARY CONSTRUCTION SCHEDULE

\*Please contact the appropriate Records Center to view the material.\*

## Section 5

### DESIGN ISSUES REQUIRING AGENCY RESPONSE

The following technical and/or regulatory issues affect the Medley Farm Site Remedial Design and require immediate Agency consideration and response:

- 1) RMT requests Agency approval to install Ground Water Pumping Wells A-1, A-4, and B-4 at the approximate locations identified on Drawing 938-C03 of this document. Pumping Wells A-4 and B-4 are to be installed for the purpose of conducting formal pumping tests. The precise locations of wells A-1, A-4 and B-4 may be adjusted slightly following review and evaluation of the initial pumping test results from wells SW-4 and S-108. Pumping Well A-1 will be installed for the purpose of obtaining additional site lithology, ground water flow and water quality information in the area of the observed bedrock "high". These wells will be installed in accordance with design criteria previously set forth and will be tied into their respective jet-pump system during the Remedial Action.
- 2) RMT requests Agency approval to install Soil Vapor Extraction Wells VE-101 and VE-301 at locations identified on Drawing 938-C05 of this document. These SVE wells will be installed during the first quarter of 1993 for the purpose of confirming the number and spacing interval of the remaining SVE wells and to obtain additional stratigraphic information in the area of the observed bedrock "high".
- 3) RMT requests Agency approval to install six one-inch vapor monitoring wells at locations described on Drawing 938-C05 of this document. These vapor monitoring wells are intended for the purpose of assessing both vertical and horizontal influences of the applied vacuum at VE-101 and VE-301.
- 4) Preliminary RMT calculations suggest that neither the air-stripper nor the SVE system will require SC DHEC air permits or VOC emissions controls. RMT requests that both US EPA and SC DHEC reviewers consider this issue and provide us with review comments regarding their technical and regulatory position in this matter.

**APPENDIX A**

**MEDLEY FARM PROJECT CHANGE NOTICE MF-003, DATED OCTOBER 19, 1992**



RMT, Inc.  
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Greenville, SC 29606  
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## MEDLEY FARM RD/RA PROJECT CHANGE NOTICE

PROJECT CHANGE NO. MF - 003

DATE: October 19, 1992

### AFFECTED DOCUMENT:

Medley Farm Site Field Sampling and Analysis Plan (FSAP), issued June, 1992

### BACKGROUND:

RMT is presently developing the Preliminary Remedial Design for the Medley Farm Site. Capture zone modelling, utilizing the GPTRAC modules of the WHPA modelling series, is being utilized to select appropriate locations for installation of site ground water recovery wells. Outputs from the WHPA model are greatly effected by differences in hydraulic conductivity and the saturated thickness of the aquifer. Since the saturated thickness of the aquifer has not been definitively established and assumptions used to estimate prior hydraulic conductivity values at the site are currently being questioned, we propose to conduct two limited pumping tests to improve our understanding of site ground water flow conditions. This action will provide us with basic data necessary to calculate the saturated thickness of the aquifer and refine site hydraulic conductivity estimates. By better defining these parameters, we hope to improve our preliminary design and optimize locations for three recovery wells, upon which full-scale pumping tests will be conducted. The following modifications to the FSAP are proposed.

### PROPOSED MODIFICATIONS:

The following sections should be inserted into the FSAP beginning on page 9-5:

#### 9.5 In-Situ Hydraulic Conductivity Testing

As deemed necessary, *in-situ* hydraulic conductivity tests may be conducted on select monitoring wells during the course of the RD/RA. Rising and/or falling-head, single-well, response tests will be performed on these monitoring wells. The necessary water displacement will be accomplished through the use of a PVC "slug" or equivalent material attached to a cord. The "slug" will then be either lowered into or pulled from an equilibrated well, thereby displacing water. Water level measurements will be collected prior to displacement and at various times as the water level re-equilibrates. A record of water level recovery with time will be used to estimate the horizontal conductivity of the formation immediately surrounding the well. Determination of hydraulic conductivity will be based on standard methods previously described by Bouwer and Rice (1969) and Bouwer (1989).

#### 9.6 Interim Ground Water Pumping Tests

Two Interim ground water pumping tests will be performed in 2-inch monitoring wells (SW-4 and SW-108) at the Medley Farm Site. The purpose of these tests is to better define the hydraulic characteristics of the aquifer (i.e., hydraulic conductivity and aquifer thickness) so that preliminary Capture Zone modelling efforts can more accurately predict the pumping rate, number, and location of the ground water recovery wells. Methods described by Hantush (1962, Refs. 9 and 10) will be used to evaluate the drawdown versus time test data.

## MEDLEY FARM RD/RA PROJECT CHANGE NOTICE

PROJECT CHANGE NO. MF - 003

DATE: October 19, 1992

### PROPOSED MODIFICATIONS (Continued):

#### 9.6.1 Pumping Wells

Monitoring wells SW-4 and SW-108 will be used as pumping wells for these tests. Both wells are constructed with two-inch nominal casing and screen. A submersible pump will be installed in the pumping well and pumped at a rate and period of time to be determination in the field. The pump will be installed with a flow control valve and flow meter capable of measuring flow to 0.1 gallons per minute. The flow meter will also utilize a flow totalizer.

Ground water removed from the pumping wells will be discharged to an open top 55-gallon drum equipped with an aspirator to air-strip volatile organic compounds. Treated ground water will then flow to a trench installed in the ground and re-infiltrate into the subsurface.

#### 9.6.2 Monitoring Wells

When pumping from monitoring well SW-4, water level data will be recorded in wells MD-2A, BW-105, and BW-111. Each of these wells and the pumping well will be equipped with pressure transducers to automatically record changes in water levels. When pumping from monitoring well SW-108, water level data will be recorded in observation wells SW-201, BW-201, SW-202, BW-202, and BW-108. As with well SW-4, all wells will be equipped with pressure transducers to automatically record changes in water level.

#### 9.6.3 Duration

These pumping tests should generally last for approximately 10 - 30 hours each. The length of the test, however, is dependent upon reaching equilibrium pumping conditions. Data generated in the field will be plotted and compared to type curves to determine the test end point.

Prior to start-up, a step drawdown test will be performed to determine the optimum pumping rate for the test. Based on data presented in the Remedial Investigation report and preliminary modelling by RMT, these pumping wells may be capable of sustained pumping rates of between 2 and 5 gallons per minute. Following completion of the step drawdown test, the system will be shut down and allowed to equilibrate.

Following the required equilibration period, each pump test will be initiated. The pump discharge rate will be set at the optimum rate established during the step drawdown test. Adjustments will be made as frequently as necessary to maintain a pumping rate that does not vary by more than  $\pm 10$  percent.

Water level measurement will be recorded in the pumping wells and observation wells at the following intervals.

<u>Stage of Test</u>	<u>Interval</u>	<u>Duration</u>
Pre-test	10 minutes	1 hour
Pump testing	15 sec	15 min
	30 sec	30 min
	1 min	60 min
	10 min	120 min
	15 min	360 min and up

## MEDLEY FARM RD/RA PROJECT CHANGE NOTICE

PROJECT CHANGE NO. MF - 003

DATE: October 20, 1992

### PROPOSED MODIFICATIONS (Continued):

At the completion of the test, all equipment will be turned off and removed from the wells. Downhole equipment and piping will be decontaminated according to the procedures described in Section 5.5.2 of the FSAP before being reused.

The following references should be added to Section 12 of the FSAP:

7. Bouwer, H. 1989. The Bouwer and Rice Slug Test - An Update. Ground Water, pp. 304-309.
8. Bouwer, M. and R. C. Rice. 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. Vol. 12, No. 3. pp. 423-428.
9. Hantush, Mahdi S. 1962. Aquifer Tests on Partially Penetrating Wells, American Society of Civil Engineers. Vol. 127, Part 1. pp. 284-308.
10. Hantush, Mahdi S. 1962. Drawdown Around A Partially Penetrating Well, American Society of Civil Engineers. Vol. 127, Part 1. pp. 268-283.

### DISTRIBUTION:

Ralph Howard (US EPA), Richard Haynes (SC DHEC), Medley Farm Site Steering Committee  
Distribution, File 938.08 (C)

EFFECTIVE DATE: September 1, 1992

US EPA REGION IV

PREPARED BY: Mark A. Miesfeldt

APPROVED BY:

*David B. Nichols*  
RMT Project Coordinator

APPROVED BY:

*Ralph O. Howard Jr.*

TITLE: REMEDIAL PROJECT MANAGER

DATE: October 20, 1992

DATE: OCTOBER 27, 1992

ISSUED BY:

*Mary Jane Norville*  
MEDLEY FARM SITE STEERING  
COMMITTEE REPRESENTATIVE

## **APPENDIX B**

### **GROUND WATER AND SOIL VAPOR EXTRACTION WELL DRILLING AND INSTALLATION SPECIFICATIONS**

## **SPECIFICATIONS FOR DRILLING, SAMPLING, AND WELL INSTALLATION**

### **1.0 SITE DESCRIPTION**

- 1.1 The project site is located near Gaffney, South Carolina.
- 1.2 Geologic Setting - The site is located within the Piedmont Physiographic province. Soils at the site are typically silty, containing varying amounts of fine sand and clay. Saprolitic soils grade downward into a decomposed rock unit ranging from 10 to 40 feet thick. Underlying the transitional soil are two crystalline rock types (bedrock) generally described as schist and gneiss.

### **2.0 SCOPE OF WORK**

- 2.1 This project involves drilling 26 soil borings. Ground water extraction wells will be installed in 8 of the boreholes. Soil vapor extraction wells will be installed in the remaining 18 boreholes.
- 2.2 Water or pore gas collected from the installed wells will be sampled and analyzed for various parameters. The testing procedures will detect minute concentrations (parts per billion range) of chemicals, grease, oil and other constituents in the ground water, whether introduced during the well drilling and installation process, or contained in the ground water or pore gas that the extraction well is intended to sample. Therefore, activities associated with drilling and well installation must be conducted in a manner that will eliminate or minimize the possibility of contaminating the borehole or well.

### **3.0 DRILLING METHODS AND PROCEDURES**

The primary drilling method will be air rotary. A secondary or optional method includes diamond bit coring.

#### **3.1 General Information**

3.1.1 Driller and other drill crew personnel must be familiar with the project drilling specifications and the drilling subcontractor's plan for health and safety, prior to their arrival on-site.

3.1.2 Work will be done by experienced personnel, using state-of-the-art equipment in good operating condition and free of leaks (fuel, hydraulic fluid, lubricants, and similar compounds).

3.1.3 Drilling and extraction well installation will be completed by a well driller certified by the State of South Carolina. The driller will be responsible for all subcontractor activity on-site, assuring compliance with the specifications and timely completion of the work. The well driller will be responsible for notifying the State of South Carolina of the well installation, upon completion, as required by South Carolina law. Copies of the notification forms will be sent to RMT.

3.1.4 The driller will assist the RMT on-site representative in completing a daily field progress report of drilling operations. This report will include: project name, date, drill crew personnel, manufacturer's designation of drill rig, a general description of work completed, and other significant activities. The driller and the RMT on-site representative will each sign the daily report upon completion.

3.1.5 Unless approved in writing by RMT, no lubricants or glue shall be used in any manner that might possibly contaminate samples, boreholes or monitoring wells.

3.1.6 Any borehole in which no well is installed, will be grouted from the bottom of the borehole to the land surface as specified in Section 3.4 of these specifications and in R.61-71.10 of the South Carolina Well Standards and Regulations.

3.1.7 The driller shall be responsible for cleaning up and restoring drill sites. This will be accomplished by spreading drill cuttings in the vicinity of the borehole and containing drilling fluids, well development water, and decontamination fluids. The driller will also be responsible for collecting trash generated during the drilling and well installation process.

3.1.8 The driller will be responsible for containing decontamination fluids in 55 gallon open top drums. A decontamination pad is available on-site.

3.1.9 Potable water and electrical power are not available on-site. The driller should be prepared to access and haul water from a hydrant located approximately 0.5 miles from the site.

### 3.2 Air Rotary

3.2.1 The primary drilling method for the installation of Soil Vapor Extraction and Ground Water Extraction wells will be air rotary techniques. When drilling and installing the ground water recovery wells, the borehole diameter will be 10 inches. The borehole diameter for the soil vapor extraction wells will be 8 inches.

3.2.2 Air from the compressor(s) will be cooled and filtered to remove particulates and organics.

3.2.3 Samples of the cuttings will be collected by the RMT representative on-site. The drilling subcontractor will be responsible for providing sample jars as described in Section 3.6.1 of these specifications.

3.2.4 Fluids generated during the drilling process must be contained in shallow excavations near the borehole. At the conclusion of the drilling and installation process, the contents of the excavation must be pumped into 55 gallon open top drums.

### 3.3 Diamond Core Drilling

3.3.1 If deemed necessary by RMTs on-site representative to determine the nature of the underlying bedrock, the driller must be prepared to advance the borehole by coring. Core drilling will be in accordance with ASTM D 2113. Core size will be NQ.

3.3.2 Drilling water will be recirculated. The settling pit (i.e. "mud tub", "sump", etc.) will be

covered during drilling operations to reduce the possibility of contaminating the drilling fluid. Equipment, such as hoses or tools, will not be placed in the settling pit if it may introduce contaminants into the drilling fluid.

3.3.3 Rock core will be placed in boxes, supplied by the drilling subcontractor. The subcontractor must provide ample spacing blocks to facilitate logging and storing of core.

3.3.4 Drilling fluids must be contained in 55 gallon open top drums.

3.3.5 The driller will be responsible for installing temporary surface casing prior to coring. After coring operations have been completed, the casing will be removed and the borehole enlarged by overdrilling with 10 inch air rotary techniques.

#### 3.4 Grouting

The driller will be responsible for grouting with a Portland cement slurry containing approximately five percent (5%) powdered bentonite. The grout slurry will be mixed by pump recirculation or other methods acceptable to RMT. When thoroughly mixed, the slurry will be pumped into the borehole or annulus via a rigid tremie.

### 4.0 WELL INSTALLATION

The driller shall be responsible for installing the ground water extraction and soil vapor extraction wells as detailed below.

#### 4.1 Construction Materials

4.1.1 When constructing the ground water recovery wells, well casing and screen will be 6 inch nominal, with threaded, flush joints. Soil vapor extraction wells will be constructed of 4 inch nominal casing and screen with treaded, flush joints. Casing and screen will be schedule 40 polyvinyl chloride (PVC). Well screens will be machine slotted. Slot size will be 0.010 inch. Casing shall be available on-site in the following lengths: 10 feet, 5 feet and 2 or 2.5 feet. Screen shall be available in lengths of 10 and 5 feet.

4.1.2 Filter sand will be Foster-Dixiana FX-50 or an equivalent. If sand other than FX-50 is to be used, the drilling contractor must submit a grain size analysis of the proposed sand to RMT prior to initial mobilization to the project site.

4.1.3 Well seals will be made up of bentonite pellets.

#### 4.2 Installation Procedure

4.2.1 Wells will be installed in a clean open borehole. Borehole must be clean and open over their entire length prior to beginning well installation.

4.2.2 After drilling is complete, casing and screen will be placed to the desired depth. Once the screen is correctly placed, the annular space around the screen will be packed with filter sand. The sand pack will extend two feet above the top of the screen. The upper surface of the sand pack will be sealed with bentonite pellets. Minimum thickness of the bentonite seal will be two feet. The bentonite pellets will be allowed to hydrate for at least 8 hours before introducing grout into the borehole. The annular space above the bentonite seal will be grouted to approximately five feet below land surface. After the grout has set, the remaining five feet will be backfilled with drill cuttings. A temporary concrete pad (2 feet x 2 feet x 4 inches) will be framed and poured around each well. The concrete pad along with the drill

cuttings will be removed at the time the jet pump assemblies and vapor extraction systems are installed. The temporary concrete pads will be replaced with 3 foot by 3 foot by 6 inch pads. The concrete pad will extend six inches below the ground surface within six inches of the borehole. Concrete will have a slump no greater than four inches. A typical Ground water recovery well schematic is included as Figure 1a. A typical soil vapor extraction well schematic is included as figure 1b.

4.2.3 The drilling subcontractor shall provide RMT with as-built well construction information on forms provided by RMT.

#### 4.3 Well Development

4.3.1 The driller will be responsible for developing the ground water recovery wells by pumping with a submersible pump until discharge is relatively clear and free of sediment. Development time will be approximately three hours per well. A surge block or swab may be necessary for proper development and must be available on-site.

4.3.2 The driller will be responsible for documenting well development on forms provided by RMT. Forms will be completed at the time of development and delivered to RMT upon completion.

4.3.3 The driller will be responsible for containing development water in 55 gallon, open top drums.

#### 5.0 DECONTAMINATION

The driller will be responsible for decontamination of the drill rig, downhole tools, sampling equipment, well construction materials and vehicles. A decontamination pad is available on-site. The subcontractor will be responsible for hauling water and providing a generator if needed.

5.1 Decontamination will be accomplished as follows.

- Steam clean;
- Rinse thoroughly with tap water;
- Rinse thoroughly with deionized water;
- Rinse twice with pesticide grade isopropanol;
- Rinse thoroughly with organic-free water and allow to air dry;
- Wrap with plastic or aluminum foil to minimize the possibility of contamination if equipment is going to be stored or transported.

5.2 Well casing and screen will be decontaminated and transported in the same manner as downhole drilling tools prior to being placed in the borehole.

5.3 Well development equipment will be decontaminated and transported in the same manner as downhole drilling tools prior to use.

#### 6.0 HEALTH AND SAFETY

6.1 The drilling subcontractor shall, as a minimum, satisfy all applicable federal, state, and local statutes, regulations, and ordinances regarding health and safety, including, but not limited to, the standards contained in 29 CFR 1926 Construction and Industry and CFR 1910 General Industry, with special attention to 29 CFR 1910.120 Hazardous Waste Operations and

Emergency Response, Interim Final Rule, U.S. Department of Labor, Occupational Safety and Health Administration.

- 6.2 RMT's Site Health & Safety Plan will be provided. The purpose of the Site Health & Safety Plan is to identify the potential hazards that RMT employees may be exposed to during activities at the site, and to define the types of training, medical surveillance, personal protective equipment and clothing, monitoring, and work practices and procedures that will be used by RMT employees for their activities at this site. In addition, RMT will furnish or make available to the subcontractor information made available to RMT by Owner that relates to identity, location, quantity, nature, or characteristics of any hazardous substance at, on, or under the site. RMT assumes no responsibility or liability for the accuracy or completeness of the Site Health & Safety Plan, and any other information provided. These documents are for the drilling subcontractor's use in preparing their own health and safety plan for their employees. RMT will not be responsible, in any way, for the health and safety of the drilling subcontractor's on-site personnel. The drilling subcontractor's employees, agents, and subcontractors shall be in compliance with drilling subcontractor's health and safety plan and procedures for the site.
- 6.3 During drilling operations, RMT may be making measurements of air quality for identification of hazards that RMT employees may be exposed to. Measurements will be made near the breathing zone of RMT employees. This information will be available to subcontractor personnel on site. RMT makes no representation or warranty with regard to the accuracy of this information.

**7.0 MISCELLANEOUS INFORMATION**

- 7.1 Drilling, well installation and associated tasks will be observed by RMT personnel on-site; drilling subcontractor personnel shall not be on-site without an RMT representative being present unless specific prior approval is given by RMT.
- 7.2 Strict project confidentiality will be maintained. Nonessential personnel should not be on-site. Inquiries from the news media or from the public will be referred to RMT immediately.

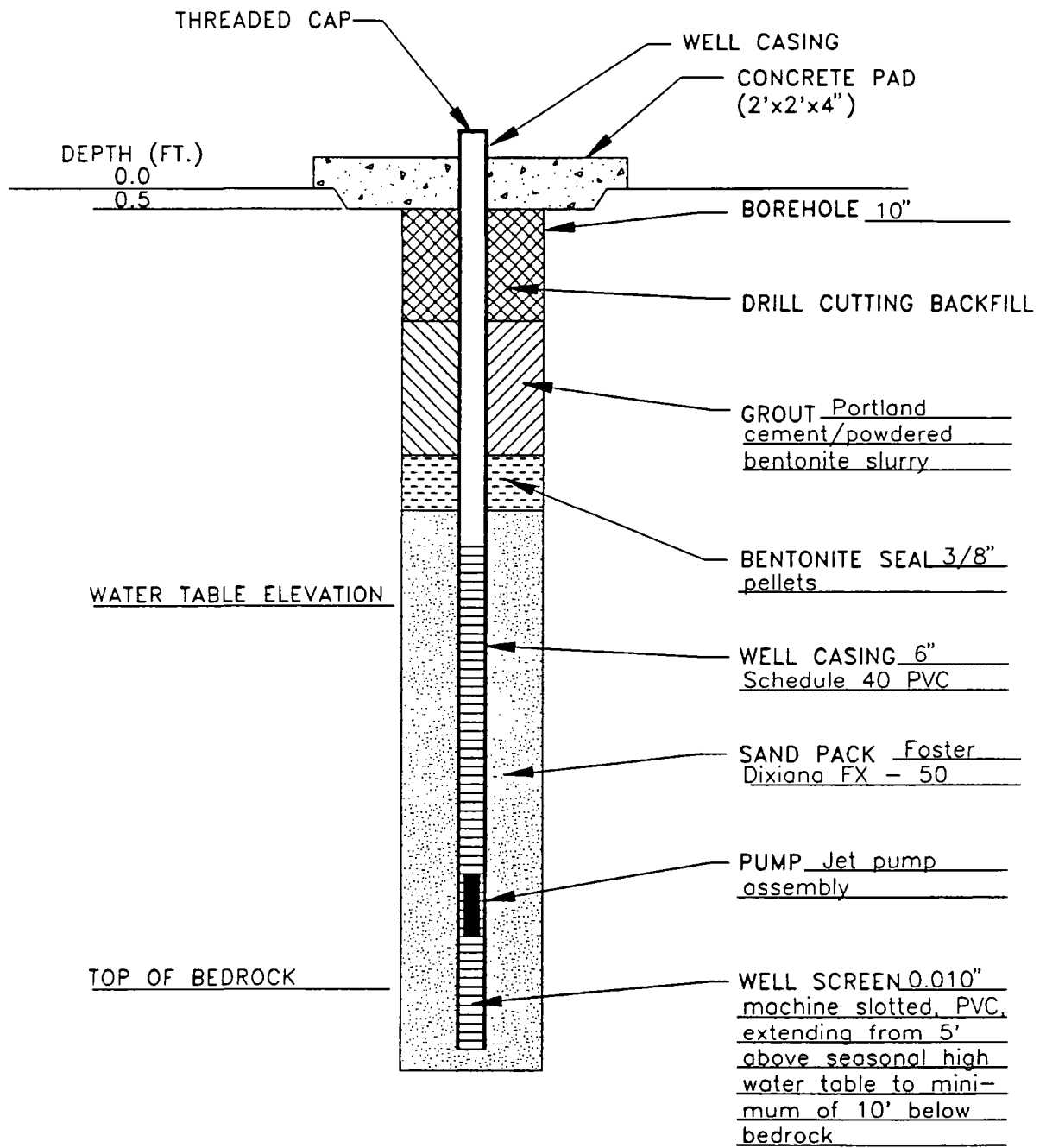


FIGURE 1a  
GROUND WATER EXTRACTION WELL CONSTRUCTION SCHEMATIC  
Not To Scale

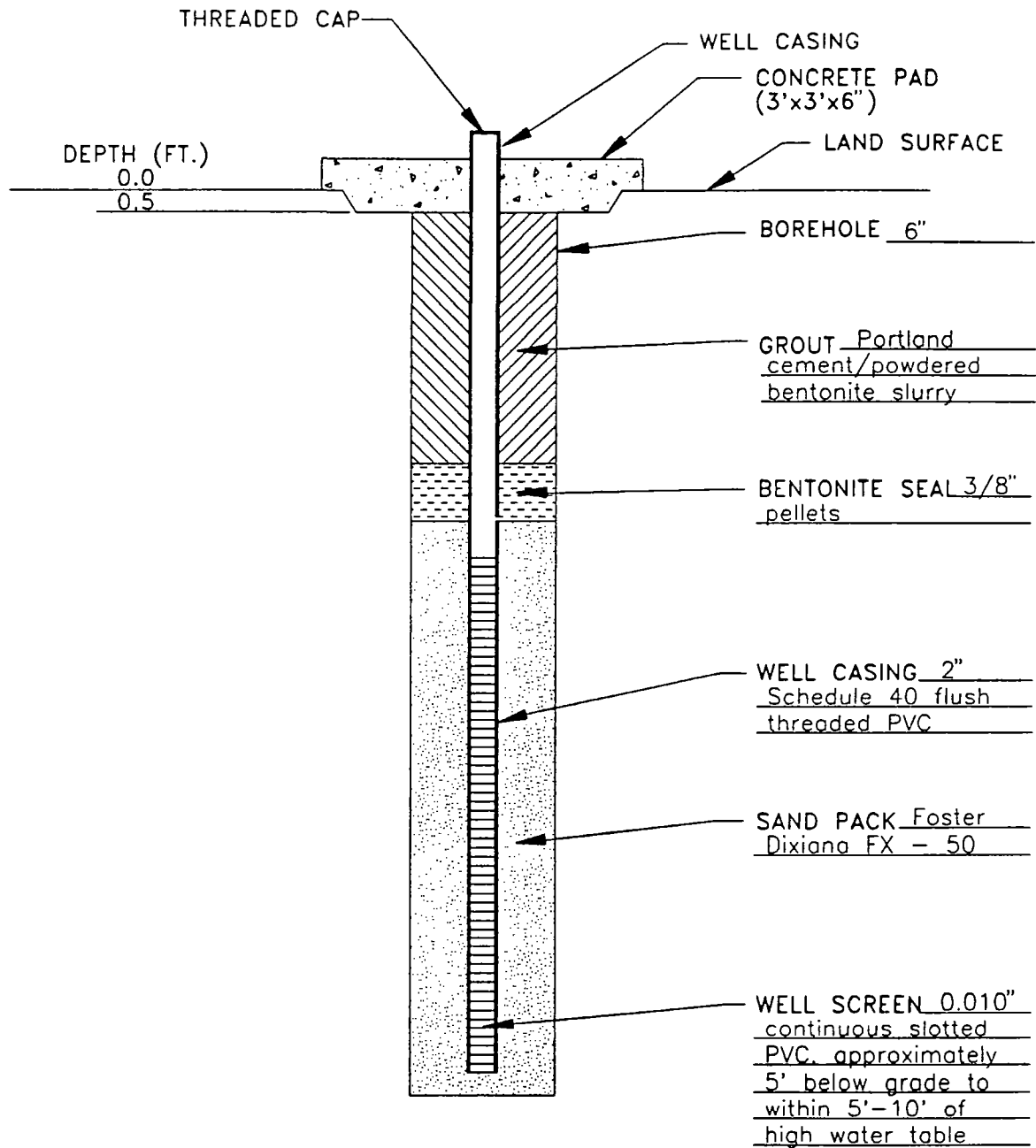


FIGURE 1b  
SOIL VAPOR EXTRACTION WELL SCHEMATIC  
Not To Scale

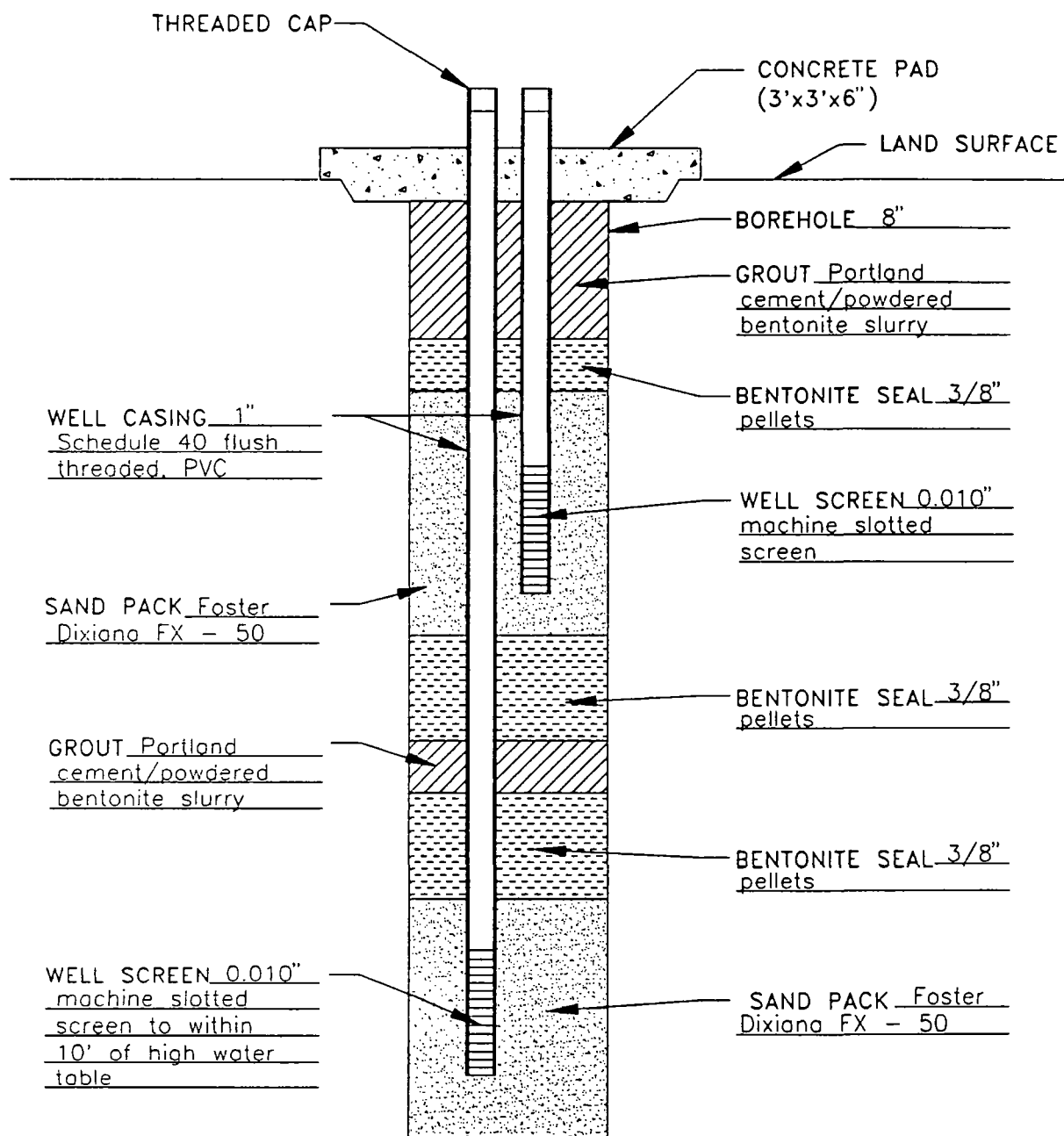


FIGURE 1c  
VACUUM MONITORING WELL SCHEMATIC  
 Not To Scale